the OIL AND GAS JOURNAL

NOVEMBER 5, 1956

How IKE and ADLAI Look At OIL

p. 60

Turbodrill Gives First Public Performance

p. 66

Radioprocessing Is Nearer Than You Think

p. 70

Also: How Phillips Approached Automatic Lease Custody Transfer p. 86

FOCUS ON OIL

Wherever wheels turn or propellors spin or jets roar fire... the focus today is on oil. Oil... liquid energy... the earth's eighth sea... source of fuels and lubricants that give unprecedented mobility to modern life. But finding and recovering this dynamic fluid takes inspiration. Sober-minded competence. Willingness to sweat. Many a trick and talent with tools and equipment. Those are qualities you'll find to match your own in Halliburton's distinguished roster of well completion services. Six Halliburton services with one focus: oil. Six mutually reinforcing technologies backed by a generation of field-leading Halliburton research. Six corps of able, conscientious craftsmen loyally devoted to one cause: putting more and more oil in the tanks of every Halliburton customer.

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OIL WELL CEMENTING COMPANY

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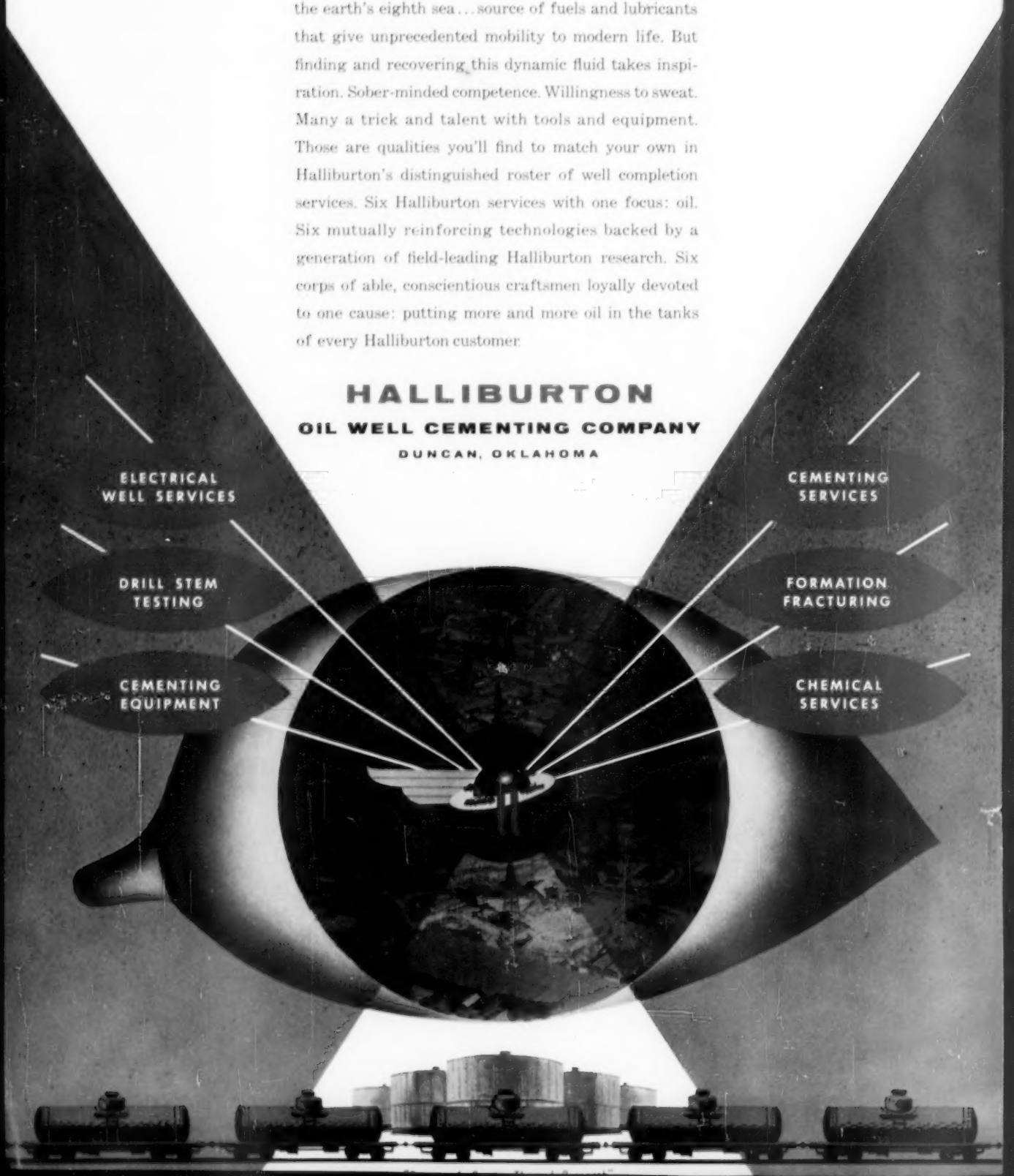

A Glance Ahead . . . . at press time

These trends will make TOMORROW'S NEWS

Fourth quarter earnings may be affected adversely by the current weakness in gasoline. Better gasoline prices which have contributed to better earnings are threatened by high year-end inventories, up 21,500,000 bbl., some 12%, from a year ago. Fourth quarter earnings, if they drop markedly, could cripple yearly earnings.

Antibiotics for curing oil well ills is a possibility. One of the nation's large pharmaceutical houses is making the study. It envisions their use as a control for anaerobic bacteria which are causing subsurface corrosion troubles in oil fields. Mass production of certain of these pharmaceuticals may bring their price in line with economics in this new use.

Shaving of the 50-tanker program seems certain. Availability of steel and the high cost of operating under the American flag will likely mean fewer tankers, all to be built by private operators.

The Government would probably have to approve an expansion program for plate to get the 1.5-million tons needed for 50 ships. That plus the high cost of American flag operation are expected to make the program little more than a speeding up of building already contemplated by private operators.

Asphalt prices should rise as the nation's refiners prepare to meet increased demands of the federal highway program. An increase is long overdue.

After years as a stepchild, companies are now looking at asphalt more realistically. Far too often it is considered a byproduct with only direct operating costs being charged to it. Indirect costs were lumped and charged to gasoline. Unrealistic low cost calculations led to equally unrealistic low sales prices.

Product pipeline expansion may be accelerated as a result of the low water levels of the Mississippi and navigable tributaries. Inland water shippers, faced with temporary use of costly tank car shipments to offset losses in barge movements, eye product pipelines with heightened interest.

Drilling research investments will increase markedly in the next decade. Trends indicate that they will go up 60 per cent just to maintain a proper relationship with gross well value. Even then such expenditures will be only a third of accepted industrial research spending for the amount of gross business. Increases in the number of wells, in the depth of wells, and in the proportion of deeper wells demand more research.

Ballooning use of microballoons is in prospect. They've proven their worth in blanketing feed stocks for catalytic units. In addition to evaporation loss and corrosion control in sour-crude storage, they may also prove useful in combating fire hazards created by static electricity when handling jet fuels. Such use, not yet fully investigated, is attracting interest.

the OIL AND GAS JOURNAL

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EXPLORATION • DRILLING • PRODUCTION • FIELD PROCESSING

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TECHNOLOGY–OPERATION

Exploration

North Texas—Land of Independents **91**
By Norman S. Morrisey
North Texas with its numerous shallow pay zones is a real haven for the independent operator. Operators drilled 2,322 wells there the first 6 months of this year. Production occurs from the grass roots, down to below 10,000 ft.

SPECIAL SECTION: Profitable Geophysical Case Histories **97**
Geophysics has been successful in mapping nearly every type of oil trap known—strat traps, complex folds, fault production, salt domes, etc. Here are a group of case histories which show its versatility.

Refining-Processing

Single-Case Reforming Teams Up with Unifining **111**
By R. L. Adee
The catalytic reformer at Continental's Billings refinery is being used as a hydrogen factory for the Unifiner.

Chart That Processing Job **120**
By Larry Resen
Esso at Baton Rouge uses a multicolumn flow-process chart to outline all the steps relating to a particular job. Once the chart is laid out, the job is analyzed, with the idea of removing all unnecessary steps.

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The Foreman's Page **123**

Field Processing **125**

Cost-imating **127**

The Refiner's Notebook **129**

Pipelining

Gas-Compressor Station Goes Automatic **94**
By R. Lochiano
The Stanton, Ky., remote-controlled station of Gulf Interstate Gas Co. has proved successful in operation. Here's how the equipment was selected, and an outline of some of the station's problems.

Pipeline Patrol: Centrifugal Compressors Cut Costs **137**
Only five men are needed to operate a 15,000-hp. centrifugal-compressor station. Part 2 in a continuing series on this subject.

Drilling-Production

Automatic Lease Custody Transfer at North Burbank **86**
By G. G. Hebard
Phillips is now operating an automatic-custody-transfer battery at the North Burbank unit in northern Oklahoma. By means of two alternating 94-bbl. metering tanks, it is handling 5,000 bbl. per day. Two pipelines are receiving the crude.

Drill-Stem Testing in High-Angle Directional Wells **113**
By C. C. Liedholm
Signal has run 12 separate open-hole tests in a 72° drift-angle well. All tests were technically successful. The method has now been proved feasible for high-angle wells.

Wire-Line Cementing Tool Has Many Uses **114**
By D. H. Stormont
Wire-line squeeze cementing is a fast way to plug off holes, squeeze perforations, or repair casing leaks. With this tool, placement position is positive and cement is relatively uncontaminated.

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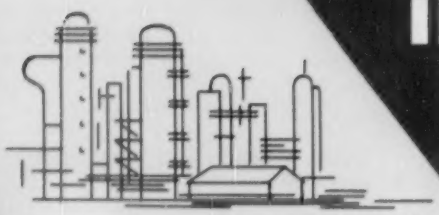
Finest

IN THE FIELD



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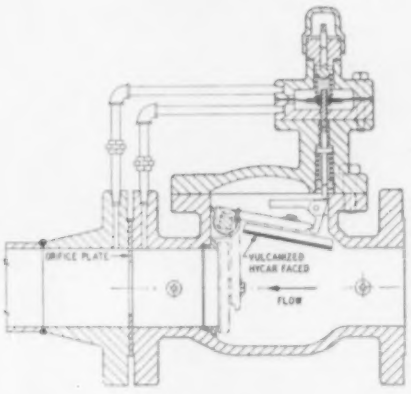
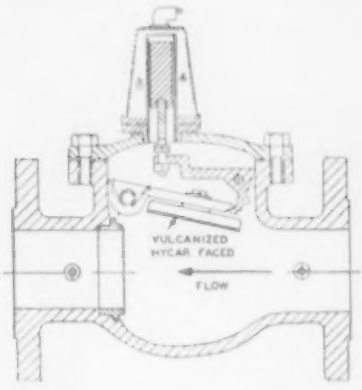


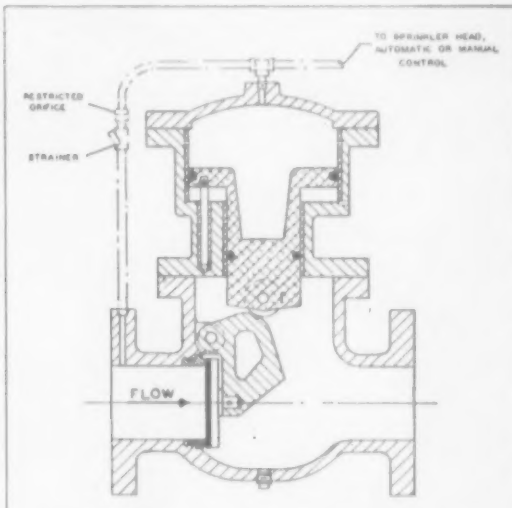
Model 1200, "Sentry" **excess flow valve** *automatically and instantaneously shuts off when the rate of flow in the line exceeds a predetermined rate.*



Models 1700 and 1800 "Sentry" **solenoid shut-off valves** *operate by remote electrical control automatically and instantaneously. In Model 1700, solenoid is energized, in Model 1800 solenoid is de-energized to maintain flow.*

"Sentry" valves are full flow valves, *for use on liquid and gas lines . . . protect property, materials and processing. Model 1200 illustrated.*

Other types "Sentry" Valves: high-pressure and low-pressure and over temperature shut-off valves available.



Model 3000 "Sentry" **piston operated quick-opening valve** *opens instantaneously when the pressure above piston is released. Ideal for deluge systems — and for remote opening and closing of fuel line.*

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These valves are *patented* quick-closing latch type and quick-opening piston type. All are full flow valves.

Latch-type "Sentry" valves are widely used in the chemical, petroleum and gas industries for closing automatically and instantaneously gas, process and fuel lines. The piston type valve can be automatically or manually opened and closed from any remote location. It is ideal for deluge systems, operates instantly; closing of this valve is against the flow, eliminating water hammer.

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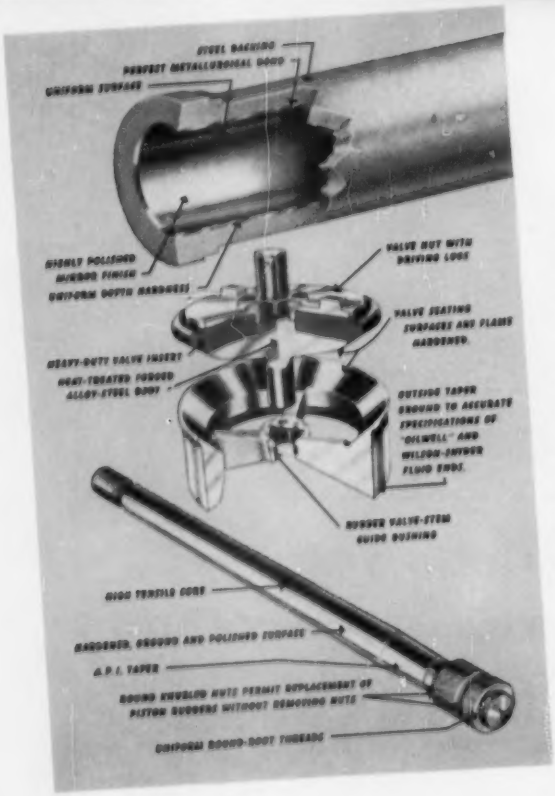
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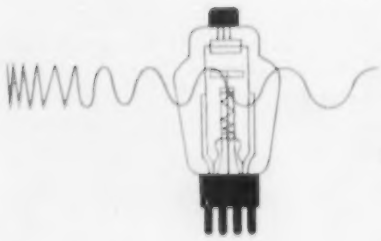
Happily, virtual immunity to almost every source of transmission error can be had with Halliburton's exclusive FM system. It's used to carry Halliburton log data ... Electric, Contact, Radiation-Guard, all the rest ... from sensing instruments and electronic transmitter in the hole to receiver and recording device aboveground. As many signals as desired, all on one lead. Modulated message unaffected by ordinary variations in amplitude. Built-in means of verifying calibration during operation. These are among the good reasons why with every month that passes Halliburton logs and analyses are winning the first-place confidence of more well-wise oilmen.

"PROGRESS IN SERVICE THROUGH RESEARCH"



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DUNCAN, OKLAHOMA

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NEW METHOD FOR OIL DISCOVERY

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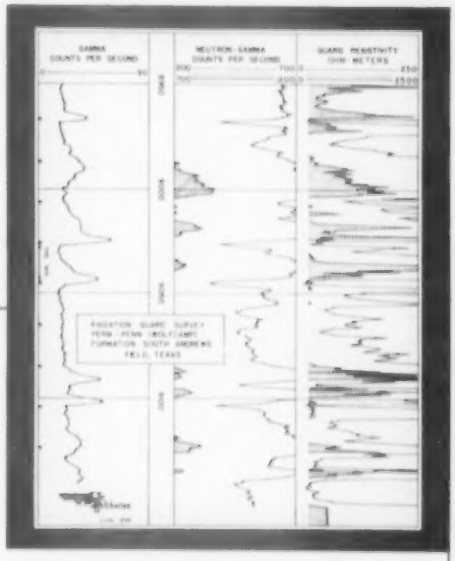
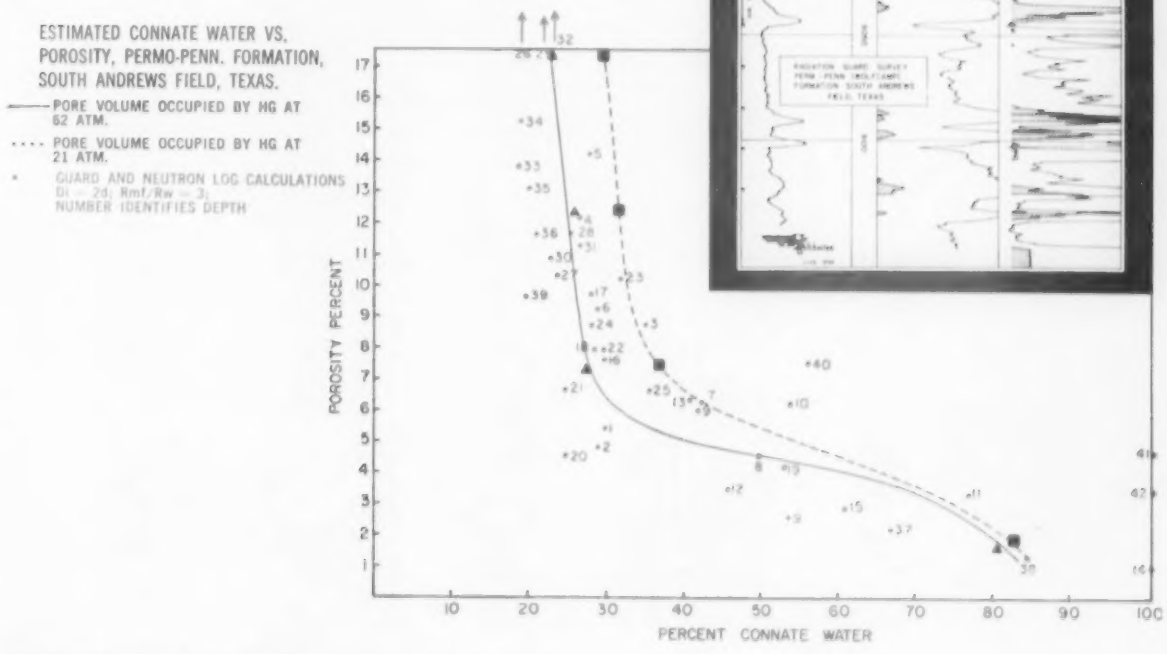
(1) Net oil in place
(2) Water production indigenous with oil
(3) Remoteness or nearness of oil-water contact

While no panacea is promised... close correspondence of data on extremely troublesome limestone, as pictured here, has been possible to date only with the Halliburton Radiation-Guard method. To get the most dependable surveys in problem wells, call your Halliburton EWS field engineer.

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PORE VOLUME OCCUPIED BY HG AT 62 ATM.
PORE VOLUME OCCUPIED BY HG AT 21 ATM.
GUARD AND NEUTRON LOG CALCULATIONS Di = 2d; Rmf/Rw = 3; NUMBER IDENTIFIES DEPTH
POROSITY PERCENT
PERCENT CONNATE WATER

COMPLETE DATA SENT ON REQUEST

Ask for "Application of Radiation-Guard Surveys to West Texas-New Mexico Province"

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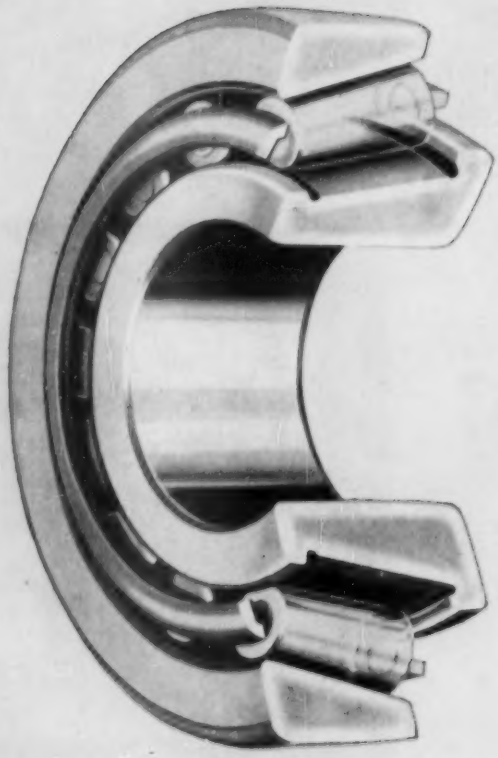

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Most important of all, when you specify Bower tapered roller bearings for your product, you get all the advantages of advanced Spher-O-Honed design—less maintenance, longer life, smoother operation. Get the full facts on the *complete* Bower line.

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Available in 3" size.

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DOW

Members of the Dow technical team are Ben Hofmeyer, with the slide rule, and (clockwise) Bill Pearce, Dick Wing, Gil McClennan, John Arnold and Herm Scholten.

huddle

Discussing the use of ***ethanolamines*** *and* ***glycols*** *with one of this team of Dow technicians often brings swift solutions to problems*

SMOOTHS OUT SWEETENING AND DEHYDRATING OPERATIONS

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MODERN LABORATORIES SPEED RESEARCH

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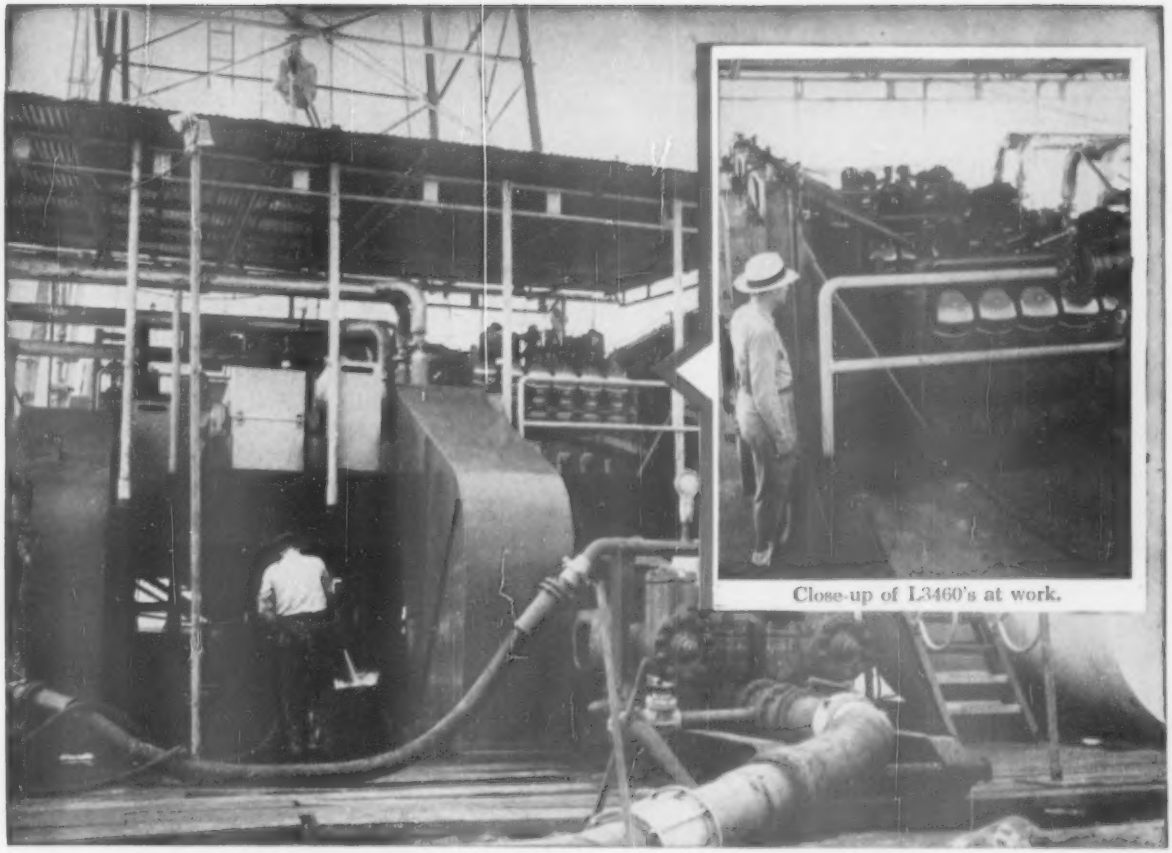


Close-up of L3460's at work.

Here's the Way to Power a Rig... for Deep Holes!

... use LeRoi L3460 or L4000 V-12 drilling engines to get the outstanding acceleration and lugging power you need for faster round trips

If you have an engine that can stand the gaff on deep holes — you have an engine that can help you bottom any hole at lower cost.

The L3460 and L4000 can do just that. It's been proven time and time again.

Let's look at the L3460. It develops 600 hp maximum. On one rig two of these engines hoisted 5-inch pipe from 8300 feet in just two hours — and this was a wet trip. That's proof of both acceleration and lugging power.

The L4000 is the L3460's twin except for displacement. It produces 655 maximum hp. Both engines are only 164 inches long so that they have the compactness that helps you keep to overall width and weight limitations. And they're built to stand oil-field handling.

Not only do you get more horsepower per dollar from these V-12's, but you also get these important features: Short-stroke design that gives you greater horsepower and speed, without compromising engine life. Wide speed range up to 1350 rpm. Operation on oilfield fuels —natural gas or butane. Conservative rating. Lightweight pistons, hydraulic tappets, short-radius rotating parts, and sensitive controls to provide hair-trigger response to load demands.

Yes, you can drill them deep and drill them fast with L3460's or L4000's. Let your supply house or Le Roi distributor show you why. If you want descriptive literature, just write us for it

P-136

LE ROI *Division of Westinghouse Air Brake Co.*

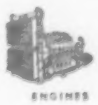
Milwaukee 1, Wisconsin

PORTABLE AIR COMPRESSORS

TRACTAIR

STATIONARY AIR COMPRESSORS

AIR TOOLS



ENGINES

Pfffft...and you've cut your costs

Valve lubrication will cut your costs. The man above is quickly and easily lubricating Rockwell-Nordstrom valves as a part of his field maintenance duties for a large oil company. This company has found that schedulized lubrication with genuine Rockwell valve lubricants assures better valve service at lower cost.(*)

Each time a Rockwell-Nordstrom valve is lubricated, a new long-lasting sealing seat is formed by the pressurized plastic lubricant. Lubricant also jacks the plug on a "hydraulic cushion" to keep the valve ready for instant, quarter-turn operation. *And lubrication is preventive maintenance* against high repair, replacement and down time costs.

Rockwell-Nordstrom valves cost no more to buy, often less, than ordinary valves. For complete information on Rockwell-Nordstrom valves and genuine Rockwell lubricants, see your nearest oil field supplier or write: Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Canadian Valve Licensee: Peacock Brothers Limited.

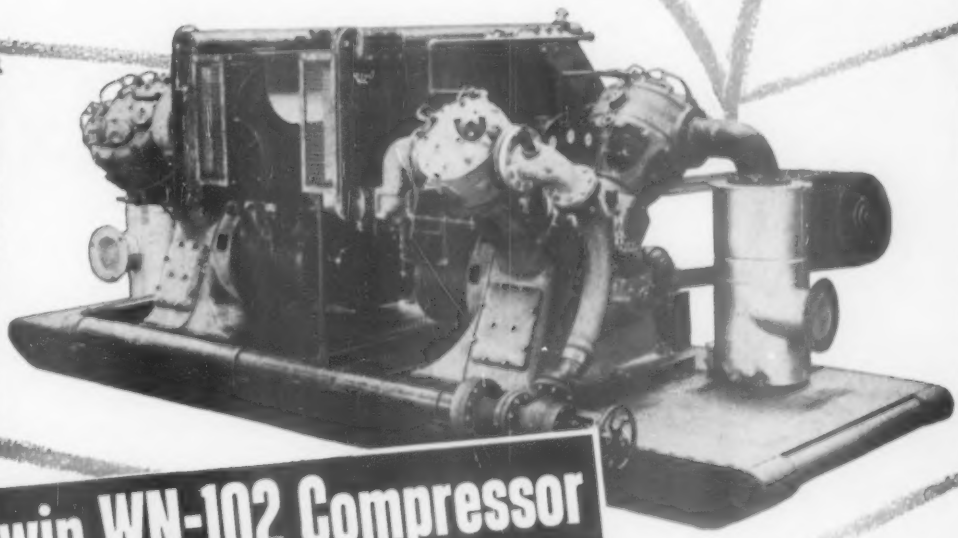
(*) If desired, valve lubrication-service arrangements may be made with Rockwell on a contracted maintenance basis. Write for cost cutting details.

ROCKWELL-Nordstrom VALVES

LUBRICANT SEALED FOR POSITIVE SHUT-OFF

40th YEAR *of lubricated plug valve leadership*

Air Drilling Package =



JOY Twin WN-102 Compressor

Move it in . . . belt it to the drilling engine . . . and begin drilling. That's all it takes to be "in business" with the Joy Twin WN-102. Here's the rundown on *why* the Joy Twin WN-102 is the ideal compressor for your air and gas drilling operations:

- *It is portable . . . mounted on a heavy, oil-field-type skid.*
- *It supplies up to 1512 cubic feet of actual air per minute at pressures up to 200 psi . . .adequate for most drilling jobs.*
- *It is driven by V-belts from the auxiliary mud-pump sheave on the drilling engine . . . requires no additional power in most cases.*
- *It is compact enough to be within highway limits when moving between drilling sites.*
- *It's designed for the job . . . only Joy supplies a heavy-duty, water-cooled package type compressor for this application.*

The Twin WN-102 is but one of the many outstanding Joy compressors which are applicable to air and gas drilling. In the complete Joy line you are certain to find just the compressor to do your job.

For complete information, write, giving full details on requirements, to **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Write for FREE Bulletin 48-31

Consult a Joy Engineer

FOR AIR COMPRESSORS • MOTORIZED DRILL RIGS
GAS GATHERING COMPRESSORS
PORTABLE LIGHTING LINES

WEW 05966-48

JOY

SPECIALISTS IN THE COMPRESSION AND MOVEMENT OF AIR AND GASES SINCE 1885

New drilling increases

Supplied by Leading Mud Companies

Magcobar *Complete* DRILLING MUD SERVICE
Drilling Milk

MACCO
LUMUL

BAROID
TRIMULSO

Three leading mud companies . . . Magcobar, Macco and Baroid . . . market the emulsifier, under their own labels, through their own extensive dealer organizations. Complete information on the application and use of this material, based on specialized knowledge and long experience, is available from these companies.

Look for this seal ▸ ▸

fluid emulsifier penetration rates

Synthetic chemical emulsifier makes low-solids, oil-in-water emulsions for high-speed drilling...making better and safer hole while reducing drilling costs six ways:

- ★ Increased Penetration Rates
- ★ Reduced Torque
- ★ Increased Cuttings Size
- ★ Longer Bit Life
- ★ Reduced Corrosion
- ★ Easier Mud Control

Compare penetration rates

By eliminating viscosity and solids build-up in the drilling fluid, drilling properties equivalent to those of fresh, clean water are maintained. Penetration rates are improved and bit-bearing life extended.

The following examples and additional information may be found in The Oil and Gas Journal for August 13, 1956. Read Ed. McGhee's article "New Oil Emulsion Speeds West Texas Drilling."

Comparison of Well Drilled with Emulsion and Well Drilled with Water and Mud

Well	Interval	Trip and Rotating Hours	Bits Used	Bit Weight	Drilling Fluid
W-1	4750'-10,300'	904	71	50-55,000	Water to 5,800' Mud to 10,300'
F-1	4750'-10,300'	606	39*	35-70,000	Emulsion to 10,300'

*Includes some chert bits

The Aquaness seal on each drum of drilling fluid emulsifier is your assurance of a top performing product . . . created and manufactured by Aquaness . . . thoroughly field tested and proven by a leading drilling contractor.

For further information, write to Magcobar about their Drilling Milk, Macco about their LUMUL, or Baroid about their TRIMULSO . . . or call the nearest distributor of these companies.

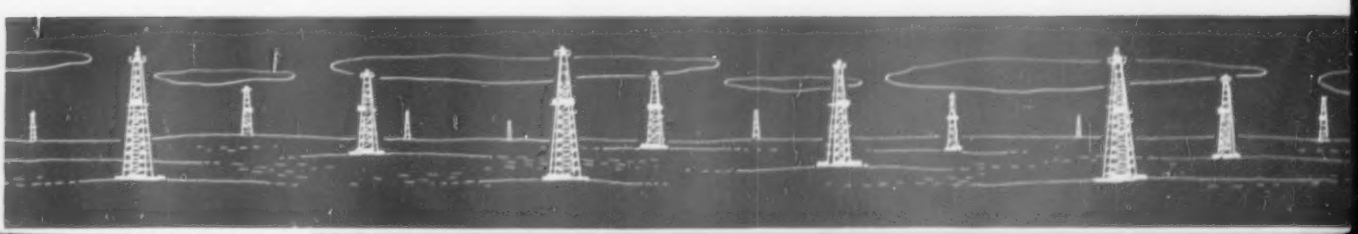
ATLAS

Aquaness *Department*

ATLAS POWDER COMPANY

2005 Quitman Street, Houston 26, Texas

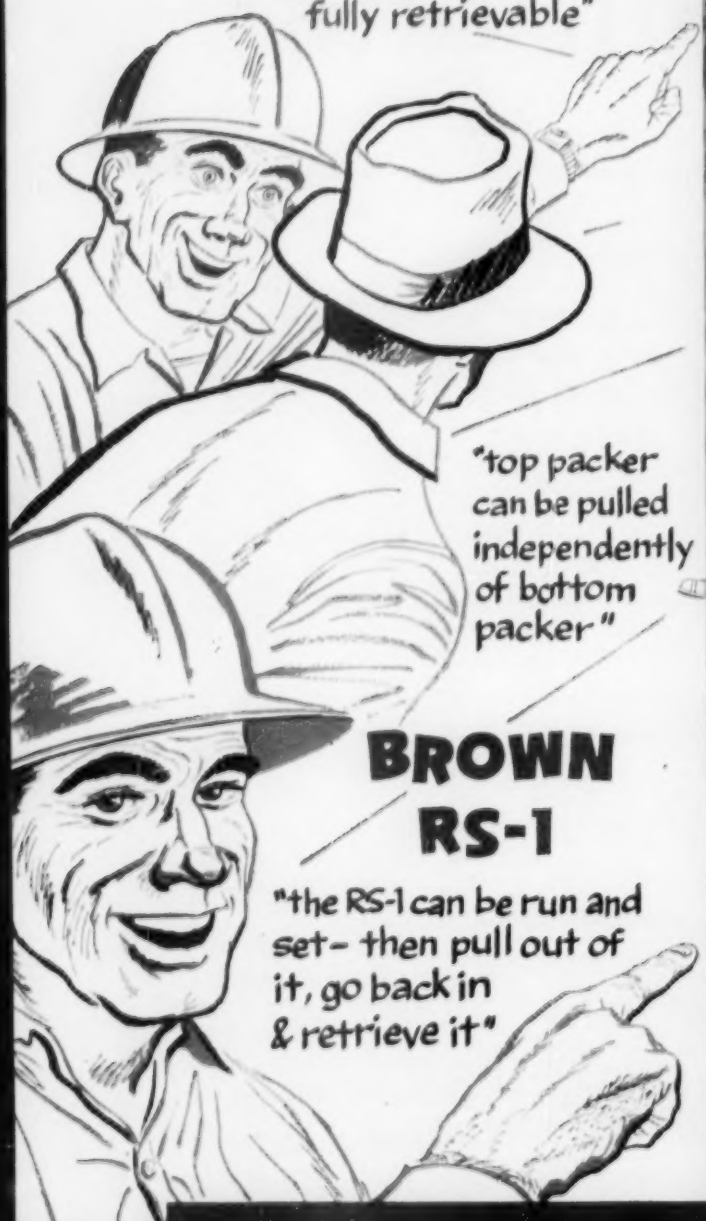
The Aquaness Seal is your assurance of uniform, top quality products.



THE BEST DUAL COMPLETION

BROWN DS-8

"both packers fully retrievable"



"top packer can be pulled independently of bottom packer"

BROWN RS-1

"the RS-1 can be run and set- then pull out of it, go back in & retrieve it"

BROWN OIL TOOLS, INC.
7214 CAMPBELL ST.
HOUSTON, TEXAS

DUAL STRING PACKER

"runs both packers simultaneously"

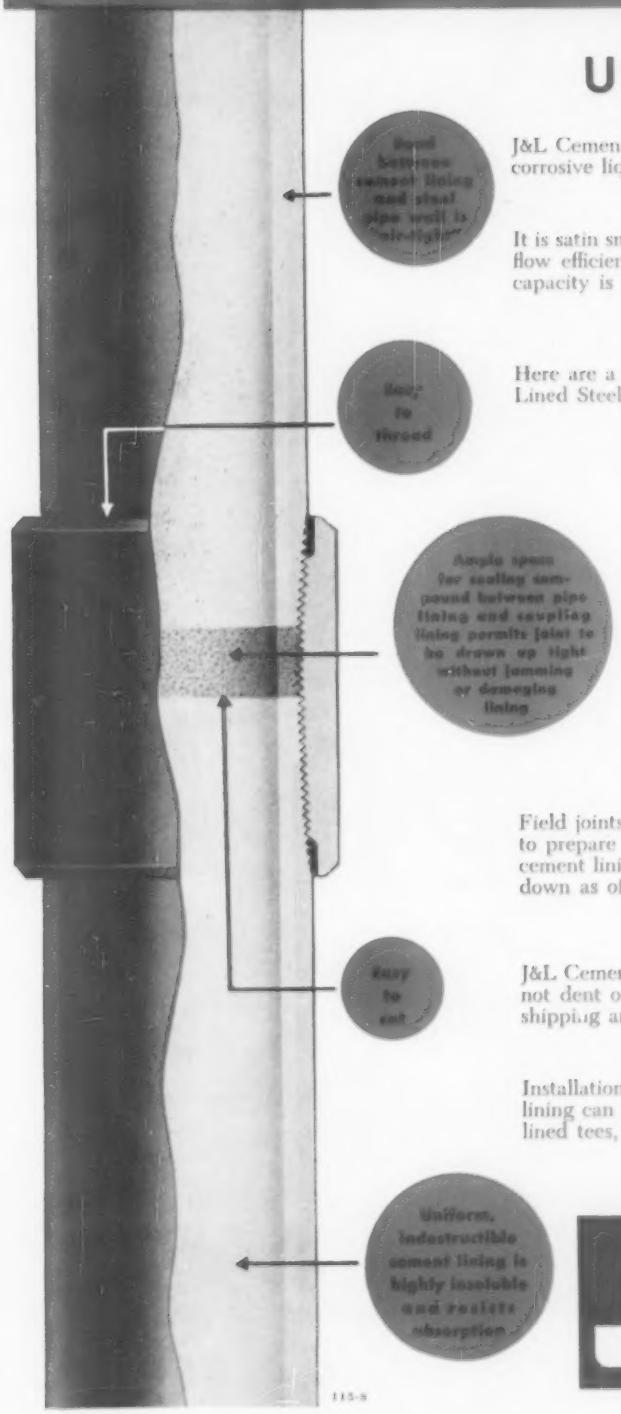
"saves time- saves money!"

For further information, write: Brown Oil Tools, Inc.

BOT

IF YOU HAVE A PACKER PROBLEM — BROWN CAN HELP

J&L CEMENT LINED CASING, TUBING, LINE PIPE


Bond between cement lining and steel pipe wall is unbroken
Easy to thread
Ample space for sealing compound between pipe lining and coupling lining permits joint to be drawn up tight without jamming or damaging lining
Easy to cut
Uniform, indestructible cement lining is highly insoluble and resists absorption
115-B

USES-ADVANTAGES

J&L Cement Lined Steel pipe is designed specifically for handling corrosive liquids.

It is satin smooth, resulting in a lower friction coefficient and higher flow efficiency than for unlined pipe. Therefore, the carrying capacity is greater than steel pipe of the same I.D.

Here are a few of the many applications in which J&L Cement Lined Steel pipe offers outstanding advantages:

1. Lines in salt works for handling brine.
2. Lines in process plants where water or other liquids must be kept free from iron contamination or rust.
3. Oil field flow lines, pipe lines, tubing and casing, where salt water, hydrogen sulfide, carbon dioxide and other corrosive materials are present.
4. Lines in paper and pulp mills for handling diluted acids and corrosive waste liquids.
5. Discharge lines in coal mines for carrying highly corrosive sulphur water.
6. Hot water lines where ordinary pipe is subject to tuberculation.
7. Municipal water works systems.

Field joints are made up with a putty-like sealing compound, easy to prepare and use. It affords protection at this point equal to the cement lining in the pipe. Field joints can be made up and broken down as often as necessary without damage to the cement lining.

J&L Cement Lined Pipe will withstand any exterior blow that does not dent or deform the steel. It requires only normal handling in shipping and unloading.

Installation requires no special knowledge or skill. The pipe and lining can be cut with a metal saw, or a power bandsaw. Cement-lined tees, ells, crosses, unions, and other fittings can be supplied.

Jones & Laughlin
SUPPLY DIVISION – Tulsa
SERVING THE UNITED STATES AND CANADA

Canada's first

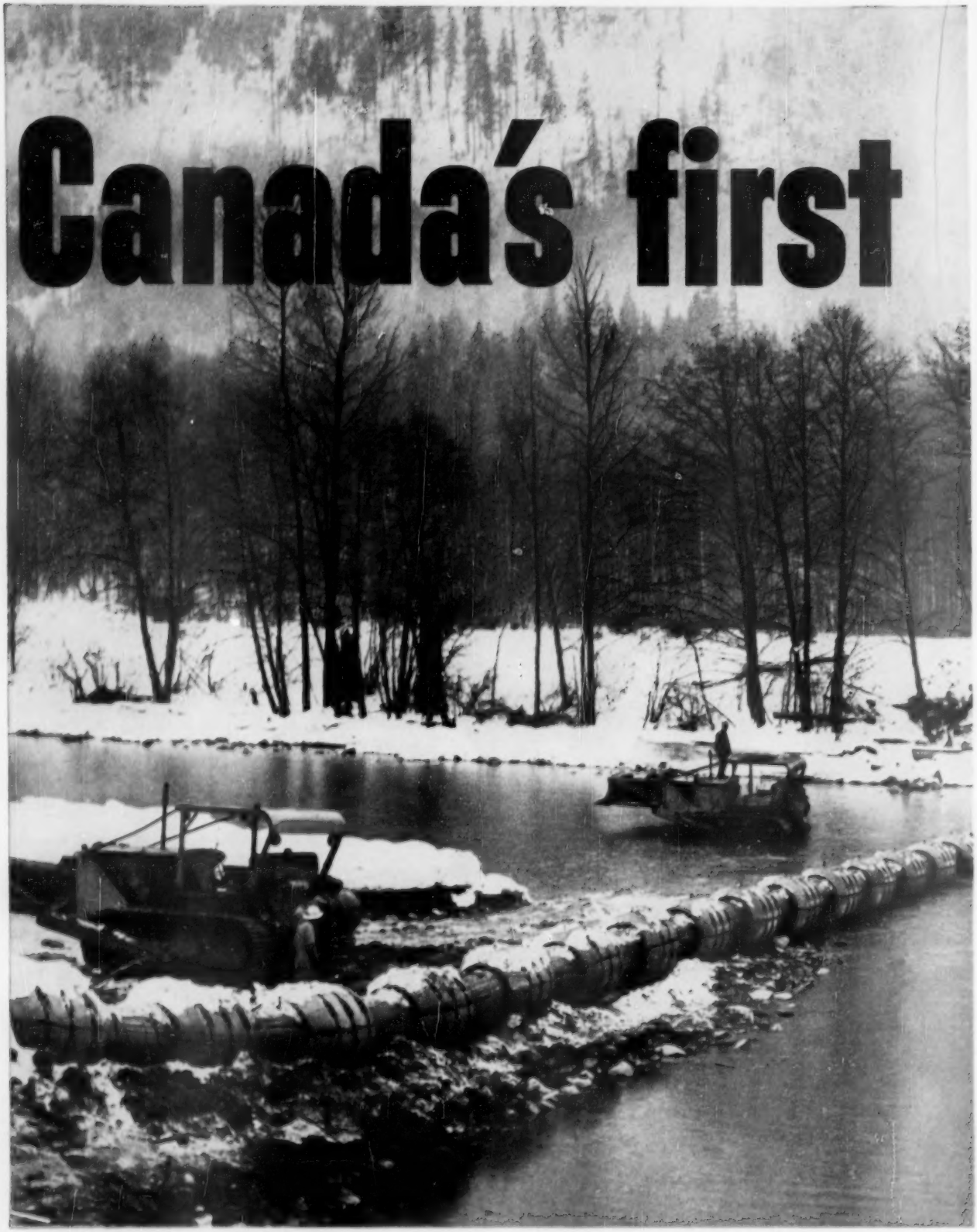


Photo shows the crossing of the Coquihalla River near Hope, British Columbia. The 30-inch diameter pipe is loaded with river weights and laid in a ditch beneath the river bed with eight feet of cover. Some of the river crossings, like this, were intentionally made during the winter when the water was at its lowest level.

"BIG INCH"

Kick-off for the line was at Huntington, B.C. Linkup with Pacific Northwest Pipelines is a short distance east of Vancouver. Westcoast has been authorized to draw gas from more than 42 million acres in the Peace River section in Alberta and British Columbia.

Westcoast Transmission Company, Limited, lays natural gas pipelines which will link British Columbia and New Mexico

TO tap the prolific gas resources of northeastern British Columbia and northwestern Alberta, Westcoast Transmission Company is now laying a 30-inch pipeline from the fields, almost due south to the international border near Vancouver. The line will provide natural gas for British Columbia and Pacific Coast States, the latter through a linkup with Pacific Northwest Pipeline Corporation which is currently completing a pipeline from New Mexico to the Northwest area.

Westcoast Transmission's 688-mile main line will have a maximum capacity of 660 million cubic feet per day and its completion will mark the first large-scale interchange of natural gas between western Canada's new and expanding fields and United States markets. Canadian Bechtel Limited are managers of engineering and construction for the project.

Marks first deliveries of 30-inch pipe from A. O. Smith Milwaukee plant

Approximately 22% of the 30-inch pipe used by Westcoast Transmission was shipped to the job from A. O. Smith's Milwaukee pipe mill. It was the first pipe of this size produced in the Milwaukee pipe mills' new facilities.

For almost 30 years . . .

A. O. Smith line pipe has always been manufactured to a high standard of quality . . . precisely controlled at every step of production. That's why A. O. Smith pipe, made and installed in 1928, is still in operation. That's why so much A. O. Smith pipe is in nearly every important high-pressure line.

Through research A.O. Smith *. . . a better way*

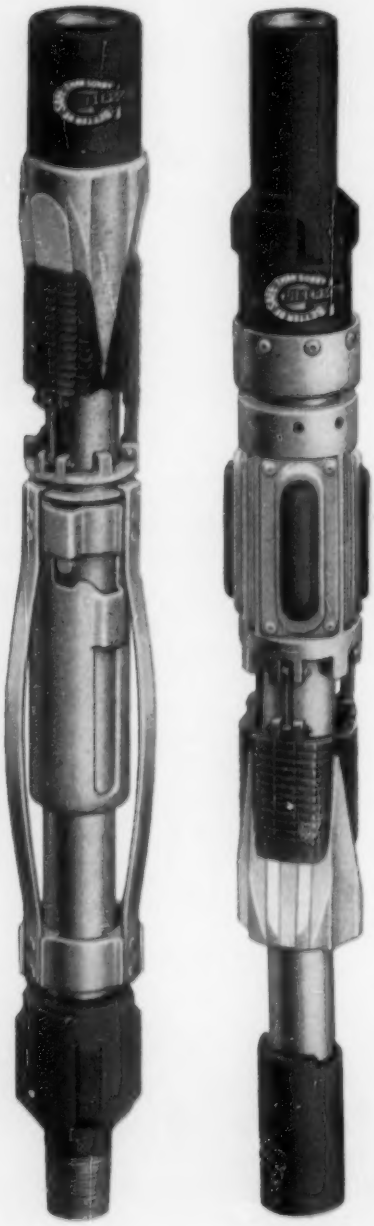
A.O.Smith
CORPORATION

TUBULAR PRODUCTS DIVISION
Milwaukee 1, Wisconsin

Chicago 4 • Dallas 2 • Los Angeles 17 • Houston 2, Texas • Midland 5, Texas
New Orleans 12 • New York 17 • Pittsburgh 22 • Tulsa 3
International Division: Milwaukee 1, Wisconsin

STOP TUBING MOTION *with a*

GUIBERSON TUBING ANCHOR



TYPE **AC**

TYPE **AF**

You get three important savings when you support pump and tubing with a Guiberson Tubing Anchor — *save wear* on tubing, on collars and threads, on casing. When string is anchored, you'll have fewer leaks and the pumping operation will yield more fluid with less power. Guiberson gives you two types to choose from.

TYPE AF is a tension tool equipped with friction pads and automatic latch. It holds when tension is applied to string. A safety joint is incorporated in the bottom connection that lets you break loose if junk fouls the latch mechanism.

TYPE AC is equipped with jay-slot and friction springs. It holds when tubing is lowered. When unlatched and pulling, Type AC functions as a tubing catcher.

Both types made in a wide range of casing sizes and weights.

THE
GUIBERSON
CORPORATION

ESTABLISHED 1919
DALLAS, TEXAS
U. S. A.

Sold by
Oil Field Supply Stores
Everywhere

Mid-Continent Supply Company gives faster service—and improves efficiency—with expanded General Electric two-way radio system

General Electric 2-way radio base station at the Snyder, Texas store handles calls to and from radio-equipped field vehicles in the area. Rig operators want fast action—Mid-Continent cuts time & mileage delays—gives superior service.

DOWN-TIME on an oil rig costs big money. To keep operating, oil men depend on the fast-moving parts and supply services provided by Mid-Continent. In turn, Mid-Continent relies on a recently expanded General Electric two-way radio network to maintain contact with field men working the oil field sites. Supply and service vehicles, equipped with mobile radio, speed customer service by cutting time and mileage delays.

Radio Now Serves Mid-Continent In Five States

Mid-Continent now operates 18 narrow-band G-E transmitters, feeding signals to 89 mobile units in a five-state area. Stores in Texas, Oklahoma, New Mexico, and parts of Colorado and Nebraska are in constant contact with their field men. An emergency repair call relayed to a mobile unit sends a man, or a part, on the way to the job site in a matter of minutes.

New General Electric Progress Line Radio

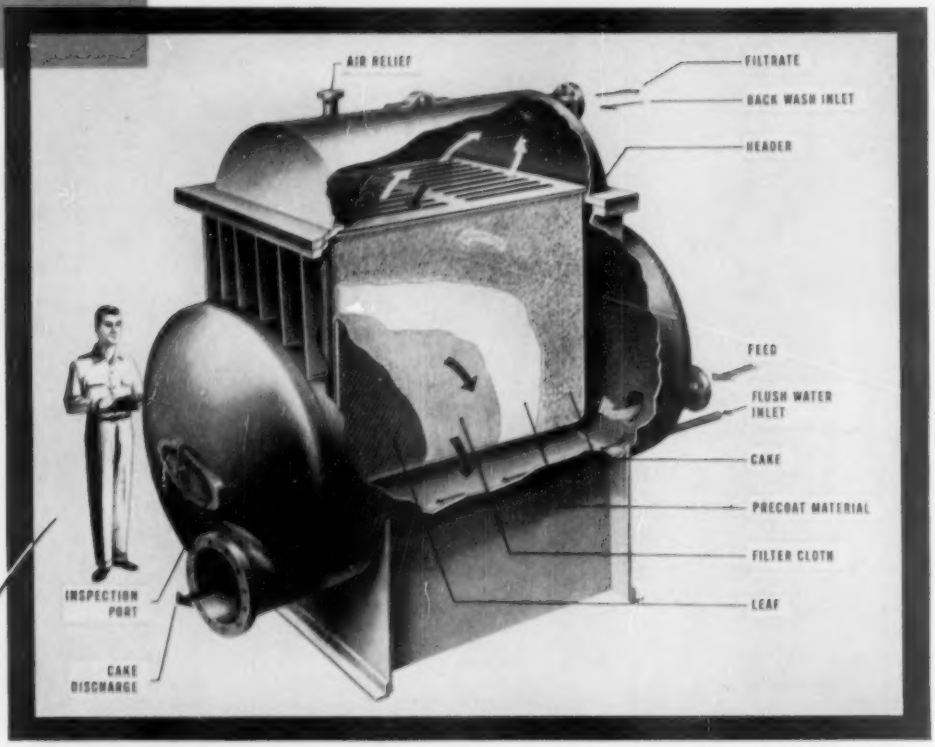
New Progress Line radios offer complete plug-in chassis design, chassis interchangeability, and they operate on 6 or 12 volt power. Only General Electric mobile radios feature the new 6600 series tubes—manufactured and pre-tested for absolute dependability in 2-way radio circuits. Ask your G-E Communications Counselor for the full details, or, write: *General Electric Company, Communication Equipment, Section X3116-5, Electronics Park, Syracuse, New York.* In Canada, write: *C.G.E. Electronics, 830 Lansdowne Avenue, Toronto.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

Interested in Secondary Recovery?

CUT RE-INJECTION COSTS WITH NEW HI-RATE PRESSURE FILTER . . .



Cutaway illustration of the D-O Hi-Rate Pressure Filter.

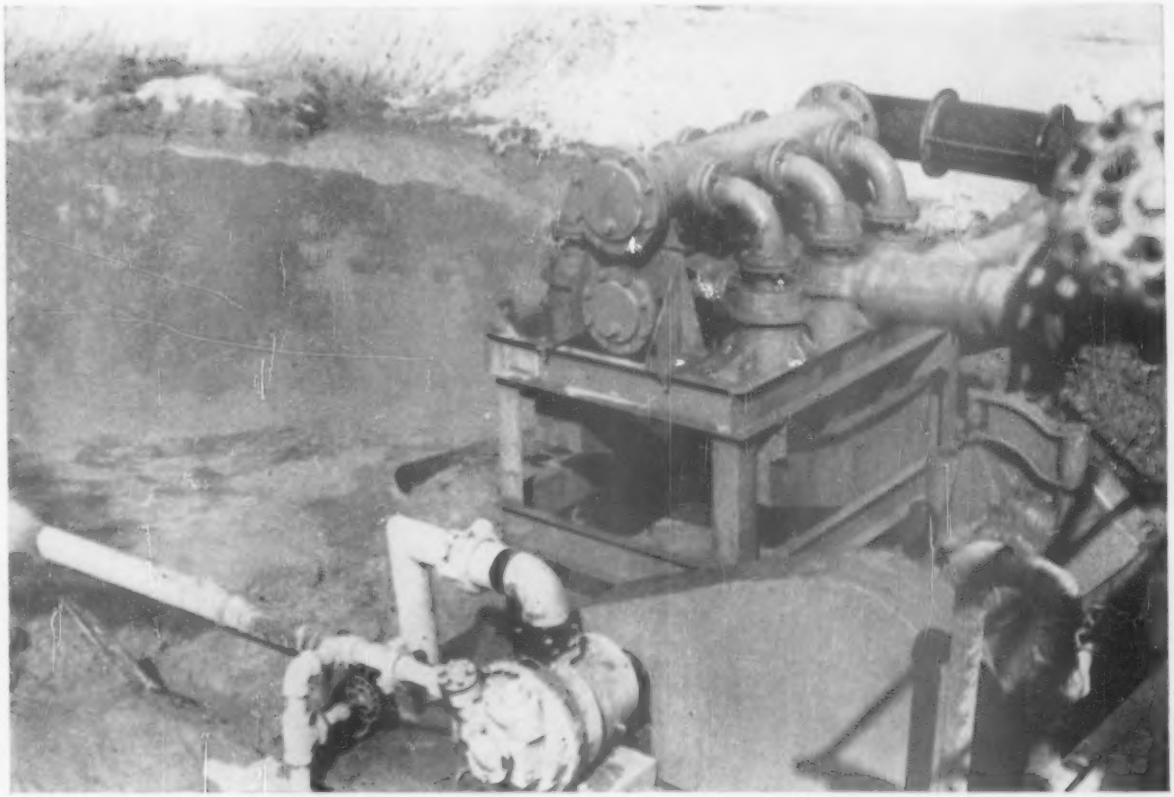
Here's a new tool to reduce costs in water flooding operations. The Dorr-Oliver Hi-Rate Pressure Filter will give you at least *double* the filtration capacity of any other leaf-type unit currently available. With this new design, filtrate flows freely upward through unrestricted, streamlined channels into the dome over the leaves and out of the unit.

Equally important, cloth cleaning is from *behind* the cloth . . . the exact reverse of filtrate flow. Water contained in the dome when filtration is stopped passes in a rush through the cloth, completely removing the cake and leaving a clean cloth for the next application of precoat.

Last but not least . . . a foolproof remote control valve system that materially reduces down time during backwash and precoat cycles. Visual control of the entire sequence is possible from any convenient location.

For more information on the Dorr-Oliver Hi-Rate Pressure Filter write for a copy of Bulletin No. 9200. Dorr-Oliver Incorporated, Stamford, Connecticut.

DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
STAMFORD • CONNECTICUT • U.S.A.



This ***D-SANDER*** has proved its value in these two important areas.

GULF COAST

The Dorrco D-Sander was originally developed to remove abrasive sands prevalent in Gulf Coast drilling down to about 9,000 feet. It has worked so well that it is rapidly becoming standard equipment on many Gulf Coast rigs.

On one series of controlled tests, for example, savings in overall drilling costs averaged more than $5,000 per well. Faster drilling rates, reduced pump repair costs and more footage per bit contributed to this saving.

MID-CONTINENT

In North Texas and Oklahoma, build-up of fine drilled solids were increasing viscosity and weight of the drilling fluid and reducing drilling rates.

SWACO Engineers set the D-Sander to remove all drilled solids above 30 microns in size and results were astounding. Drilling rates increased as much as 15 per cent. Bit footage increased as much as 25 per cent and mud control was greatly simplified. Important cost savings were realized.

Regardless of where you drill, the Dorrco D-Sander may save you money by maintaining a low solids, low weight, non-abrasive drilling fluid. For full information, call us.

SWACO

SALT WATER CONTROL Inc.

A Sid Richardson Development Company

1211 Ft. Worth National Bank Phone: ED 2-4434 Ft. Worth, Texas

OVER THE ROAD

OVER THE HOLE

Torqmatic serves two masters in a Hopper Hoistmobile

(in slim hole drilling, it's Torqmatic all the way)

Two masters—a driller and a driver—boss the Allison TORQMATIC DRIVE in a Hopper Hoistmobile. And both will tell you that this torque converter-transmission team is a power-transmitting sweetheart, whether it's propelling the Hoistmobile over the road or running a drill string.

Over the road the speedy Hoistmobile travels at a 40-mile-an-hour pace. The TORQMATIC DRIVE eliminates the need for a clutch pedal, permits quick-shifts at full throttle with finger-tip control. With its TORQMATIC DRIVE the Hoistmobile shows its heels to tractor-trailers on steep hills, moves from well to well like a whirlwind.

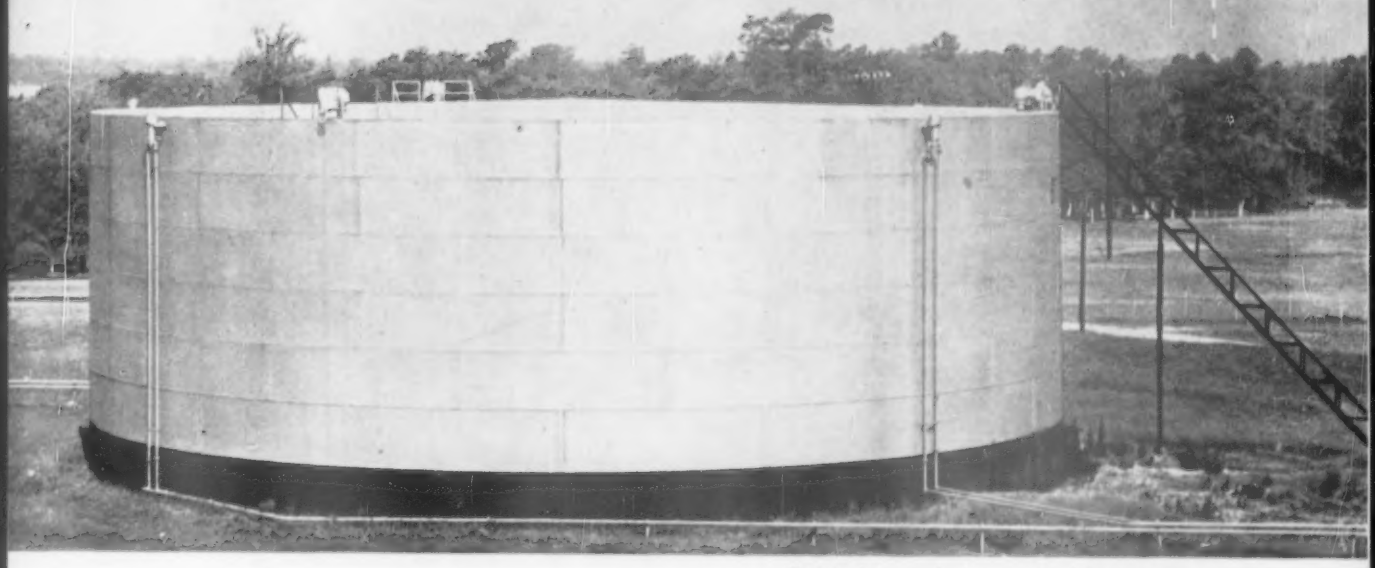
Over the hole, the driller takes over on the TORQMATIC DRIVE. Its ability to start a string off bottom in low, then quick-shift to high at the push of a button, means faster pipe-pulling, less time spent on every well. What's more, the TORQMATIC Converter takes it easy on drill pipe because it has a built-in oil cushion to absorb damaging shocks.

You can get Allison TORQMATIC DRIVES in drilling, servicing and fracturing rigs made by almost every leading manufacturer. For the names of these manufacturers, write Allison Division of General Motors, Box 894R, Indianapolis 6, Indiana.

GM TORQMATIC *Allison* TORQMATIC DRIVES

Sinclair tank reduces evaporation every working hour

with Microballoon spheres*



Test tank has a discharge rate of 2000 bbl. per hour, with five turnovers per month. Average temperature is 75 deg. F. RVP is 5.6 psi. Since its evaporation loss was about half that of the control tank, additional tanks at this **Sinclair Refining Co.** location are due for this system of evaporation control.

For more than two years, Sinclair Refining Co. has had one of its older 80,000-bbl. cone-roof tanks at Houston, Texas, equipped with a vapor-stopping seal of Microballoon* spheres made from BAKELITE Brand Phenolic Resins.

Results of this test now show that evaporation loss was approximately half that of the control tank, which had no seal.

The effective use of the foam seal treatment can help you reduce needless waste due to evaporation.

To learn more about this method of control, write Bakelite Company, or *Chicago Bridge & Iron Company, Chicago 4, Ill.*

*Registered trade-mark of The Standard Oil Co. (Ohio)

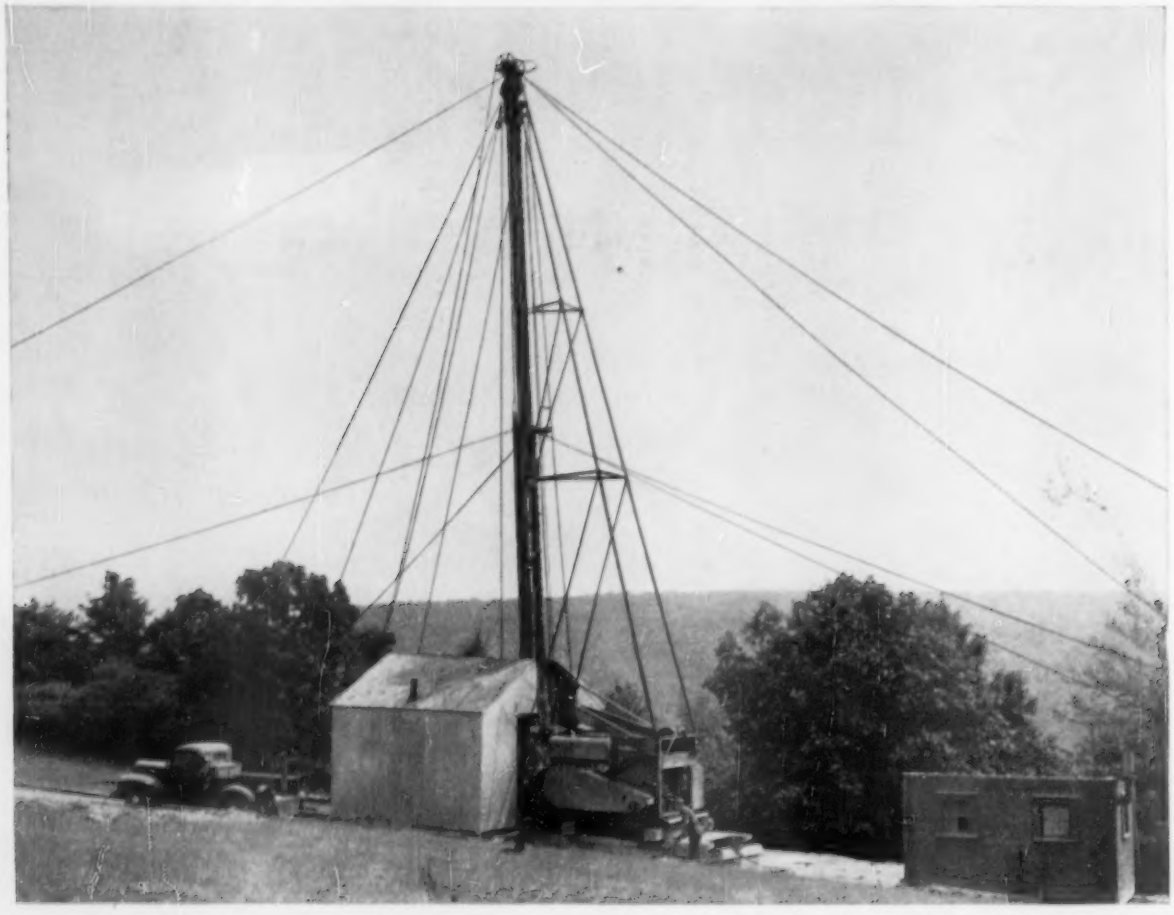
for evaporation control . . .

BAKELITE BRAND **RESINS**

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

In Canada: Bakelite Company, Division of Union Carbide Canada Limited, Belleville, Ontario

The term BAKELITE and the Trefoil Symbol are registered trade-marks of UCC



Why BUCYRUS-ERIE Spudders pay off on Secondary Recovery

Bucyrus-Erie spudders offer the speed and mobility you need for fast, profitable secondary recovery operations. These modern rigs assure rapid progress hole after hole, with quick easy moves and reduced costs all down the line.

You can't beat the *speed* with which Bucyrus-Eries put down hole. Snappy spudding action, with shock absorber that can be blocked out for deep drilling, means real drilling speed in any formation. Forward and reverse speeds on all reels and on the catheads provide the accurate, split-second control that diversified operations require. Reels are free-wheeling for lowering. Fast powerful line pulls result in fast trips in handling tools, bailer, casing, or rods in clean-out work.

And when it comes to moves, Bucyrus-Eries really save time. Their telescoping derricks are lowered and raised quickly under power, tubular braces unfold smoothly. Mobile semi-trailers or skid mountings make *moving* easy.

Two popular choices for secondary recovery work are the 60-L and 28-L machines. For complete information on them, see the Bucyrus-Erie spudder distributor in your area or write us direct. 30556

60-L Top-to-bottom drilling to 1,500 ft.; Servicing to 2,000 ft.; Swings up to 2,750 lbs. of tools.

28-L Top-to-bottom drilling to 2,500 ft.; Servicing to 3,000 ft.; Swings up to 3,700 lbs. of tools.

BUCYRUS ERIE

SOUTH MILWAUKEE, WISCONSIN

FIRST with the FINEST in SPUDDERS

New Copper Deactivator Guaranteed not to freeze!

This special all-weather UOP Copper Deactivator formulation will not freeze when stored for extended periods at temperatures down to 0° F. We call it Copper Deactivator-AW(50)*, since it contains active ingredient in 50% concentration. This new formulation completely eliminates the low temperature pumping problems common to other deactivators.

AW(50) gives maximum metal deactivating efficiency and economy. Improved color, too, and because of its better solubility and pumping properties, it can be injected directly into gasoline or other refinery streams without the customary dilution with aromatic spirits.

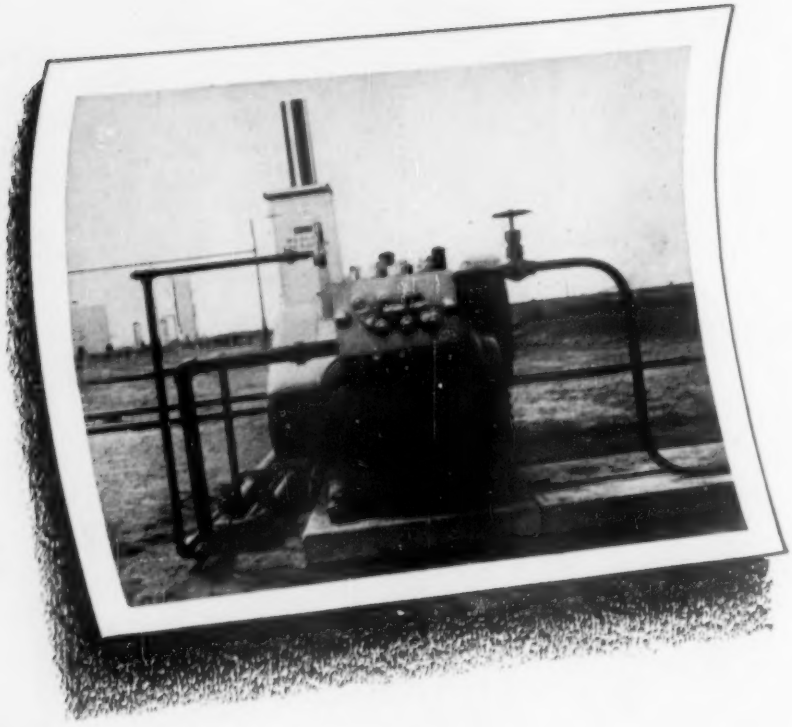
AW(50) is supplied in handy five-gallon containers for manual addition or blending with other additives and in 55-gallon drums for automatic injection systems.

*Trademark of Universal Oil Products Company

PRODUCTS DEPARTMENT

UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD, DES PLAINES, ILLINOIS, U. S. A.



You can depend on GAULIN TRIPLEX PUMPS to keep on working...

Horizontal design of these hydraulic pumping units completely separates cylinder from crankcase, preventing any product leakage to crankcase.

Plexiglas wall covers give an instant visual check of cylinder plunger and packing operation.

Corrosion-proof cylinder is made of stainless. Hardened stainless or ceramic plungers available.

Spring-loaded plunger packing is self-adjusting, self-sealing, eliminating the human element.

API ball valves and removable seats permit quick adjustment in the field.

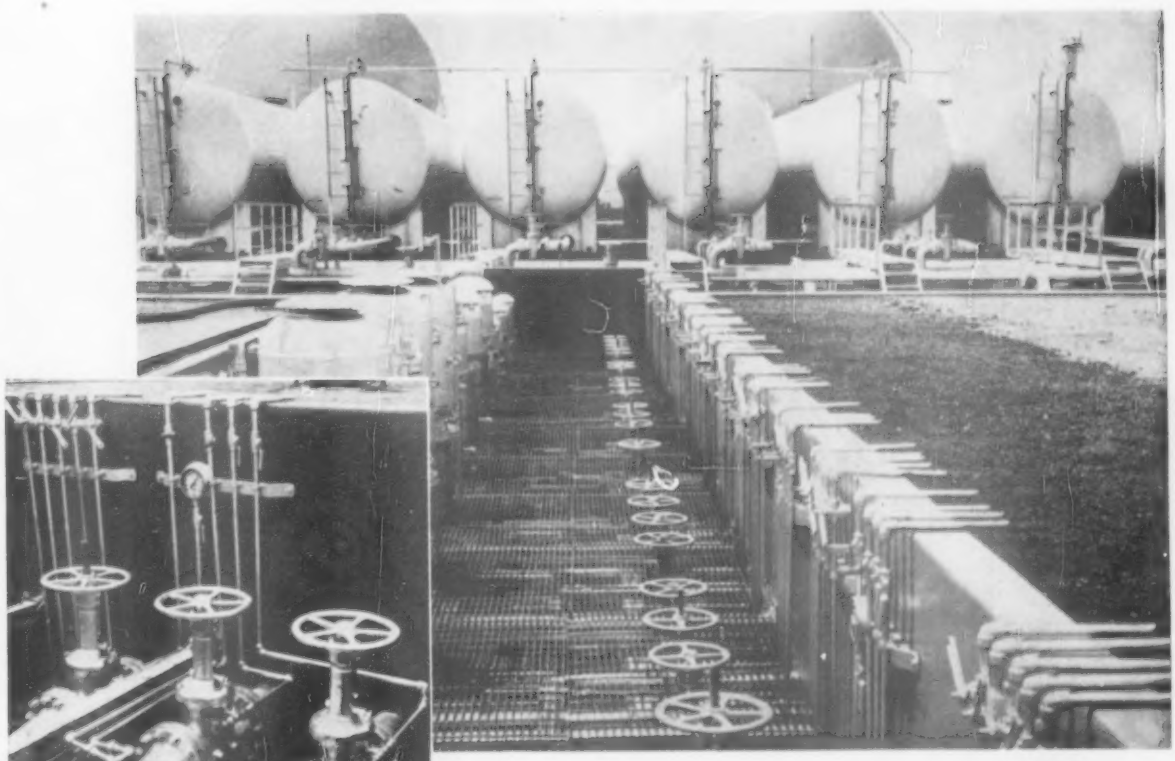
Wide volume and pressure ranges are provided by Gaulins because plunger sizes and drive speeds can be quickly changed in the field.

Manton-Gaulin
MANUFACTURING COMPANY, INC.
EVERETT, MASSACHUSETTS
73 Garden Street

MANTON-GAULIN MANUFACTURING CO., INC., LA HABRA, CALIFORNIA
M. Les Walraven, Mgr. Oil Field Sales (Oxford 7-6334) (Long Beach 4-1596)

or call: SPECIALTY SALES & SERVICE, INC.
Tulsa, Oklahoma — (Tulsa 5-42226) Odessa, Texas — (Odessa 6-6921)

Gaulin



A SINGLE W-K-M VALVE PROVIDES DOUBLE BLOCK AND BLEED PROTECTION

W-K-M non-lubricated gate valves with parallel expanding gates and TEFLON* seats seal vapor-tight on both the upstream and downstream seats, regardless of the direction of pressure. This provides the same protection as two conventional valves in a double block and bleed hookup. As the illustration above shows, the bleed line is attached to the body through a tapped opening, thus making it possible to bleed the body completely while holding securely a different gaseous or liquid product on each side of the valve. In addition, the stem on W-K-M rising stem valves is out of the body—to permit lubrication of the threads for easier opening and closing. The valve stem also serves as an "open"—"closed" indicator.

When you use W-K-M valves in such installations you save from ⅓ to ½ in valve costs and also save in piping and hookup time; in operation there is only one valve to handle instead of two.

Before you plan your next manifold, investigate W-K-M valves. They provide the most economical and efficient means of protecting your products from contamination.

*DUPONT TRADE NAME

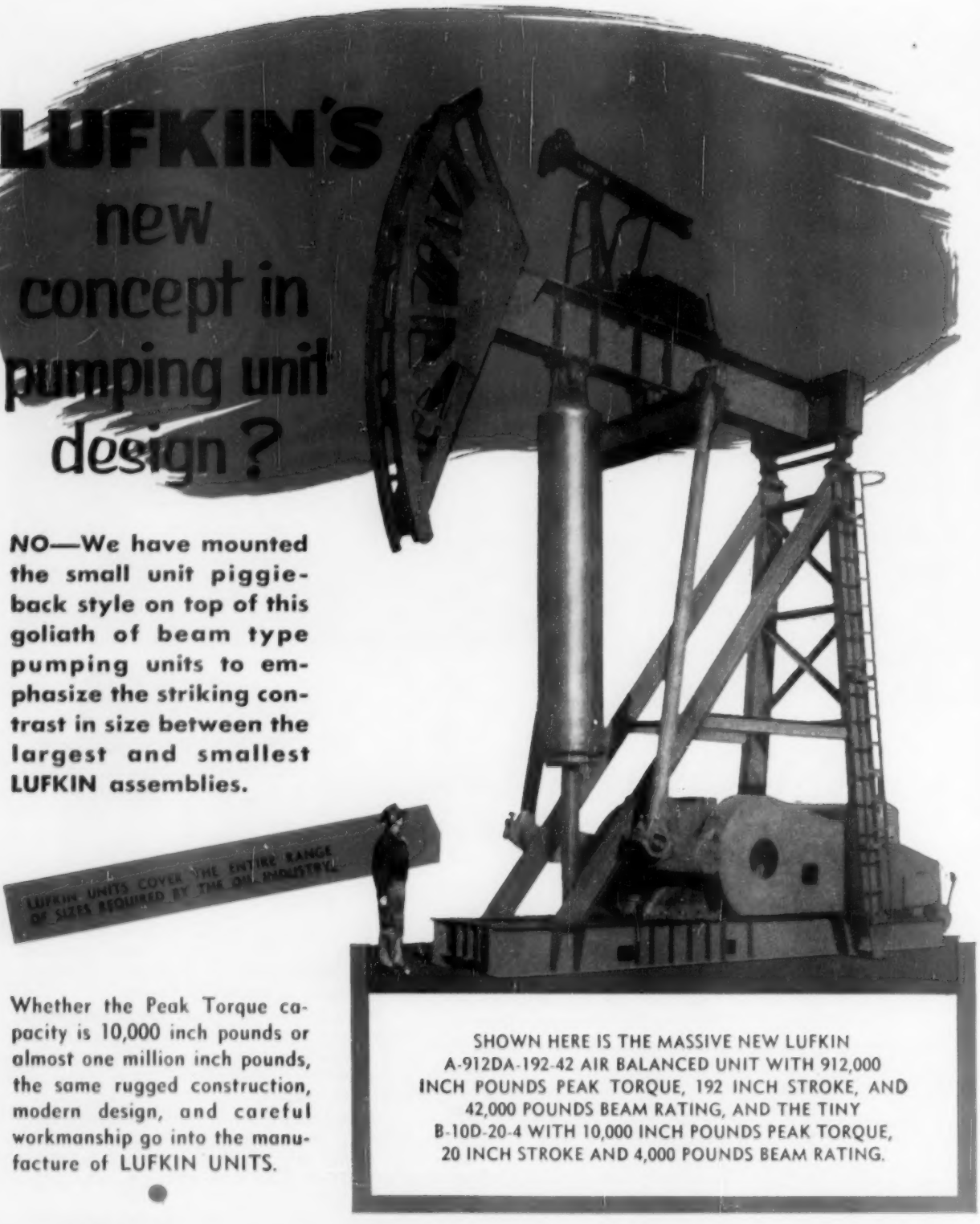
5509

W-K-M
DIVISION OF acf INDUSTRIES INCORPORATED
PLANT: MISSOURI CITY, TEXAS
MAILING ADDRESS: P. O. BOX 2117, HOUSTON, TEXAS

MANUFACTURERS OF

W-K-M	acf	KEY
THROUGH-CONDUIT GATE VALVES	LUBRICATED PLUG VALVES	RETURN BENDS AND FITTINGS

LUFKIN'S new concept in pumping unit design?



NO—We have mounted the small unit piggie-back style on top of this goliath of beam type pumping units to emphasize the striking contrast in size between the largest and smallest LUFKIN assemblies.

Whether the Peak Torque capacity is 10,000 inch pounds or almost one million inch pounds, the same rugged construction, modern design, and careful workmanship go into the manufacture of LUFKIN UNITS.

SHOWN HERE IS THE MASSIVE NEW LUFKIN A-912DA-192-42 AIR BALANCED UNIT WITH 912,000 INCH POUNDS PEAK TORQUE, 192 INCH STROKE, AND 42,000 POUNDS BEAM RATING, AND THE TINY B-10D-20-4 WITH 10,000 INCH POUNDS PEAK TORQUE, 20 INCH STROKE AND 4,000 POUNDS BEAM RATING.

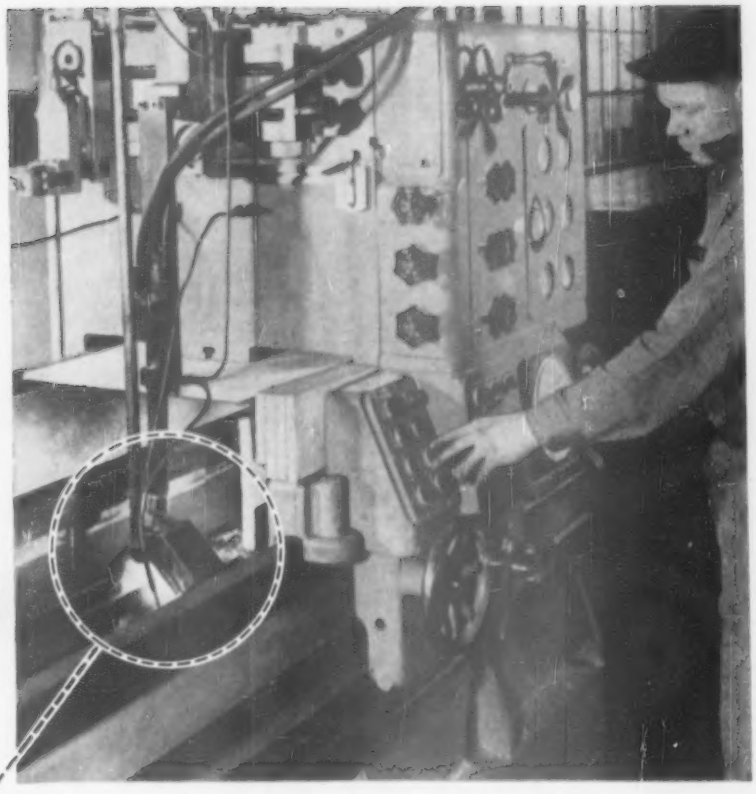
Lufkin FOUNDRY & MACHINE COMPANY

LUFKIN, TEXAS

Branch Sales and Service: Houston • Dallas • New York • Tulsa • Los Angeles • Seminole • Oklahoma City • Corpus Christi • Odessa Kilgore • Wichita Falls • Casper, Wyoming • Great Bend, Kansas • Effingham, Illinois • Duncan, Oklahoma Brookhaven, Mississippi • El Dorado, Arkansas

Lufkin equipment in Canada is handled by THE LUFKIN MACHINE CO., LTD. 9950 65th Avenue, Edmonton, Alberta, Canada 3913 18th Avenue, Regina, Saskatchewan, Canada

HIGH SPEED FLAME-HARDENING



Cross-section view shows uniform depth of hardened surface.

SPECIAL MACHINE UPS LIFE OF GRAPHITIC STEEL PARTS

LINDE engineers have assisted Cincinnati Steel Treating Company in developing a flame hardening machine which increases service life of 16 ft. long, graphitic carbon steel lathe ways . . . Development of this automatic, high speed machine is another example of how LINDE Service Engineers are helping LINDE's customers up production speed and unit quality through co-operative research engineering.

With this new machine, a lathe way to be treated is placed on a magnetic chuck in a water filled channel. Flame-hardening heads and control mechanism move at predetermined speeds along the part. After it cools, the lathe way is placed in a refrigerator for 24 hours which stabilizes the steel, and brings its case hardness to a minimum of 60 Rockwell "C" scale.

The benefits of LINDE's research, engineering, and over 40 years of accumulated know-how stand behind each of its customers to help them solve production problems. Get these "plus-values" which LINDE offers—it pays you to do business with LINDE.

Linde Air Products Company
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
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Linde
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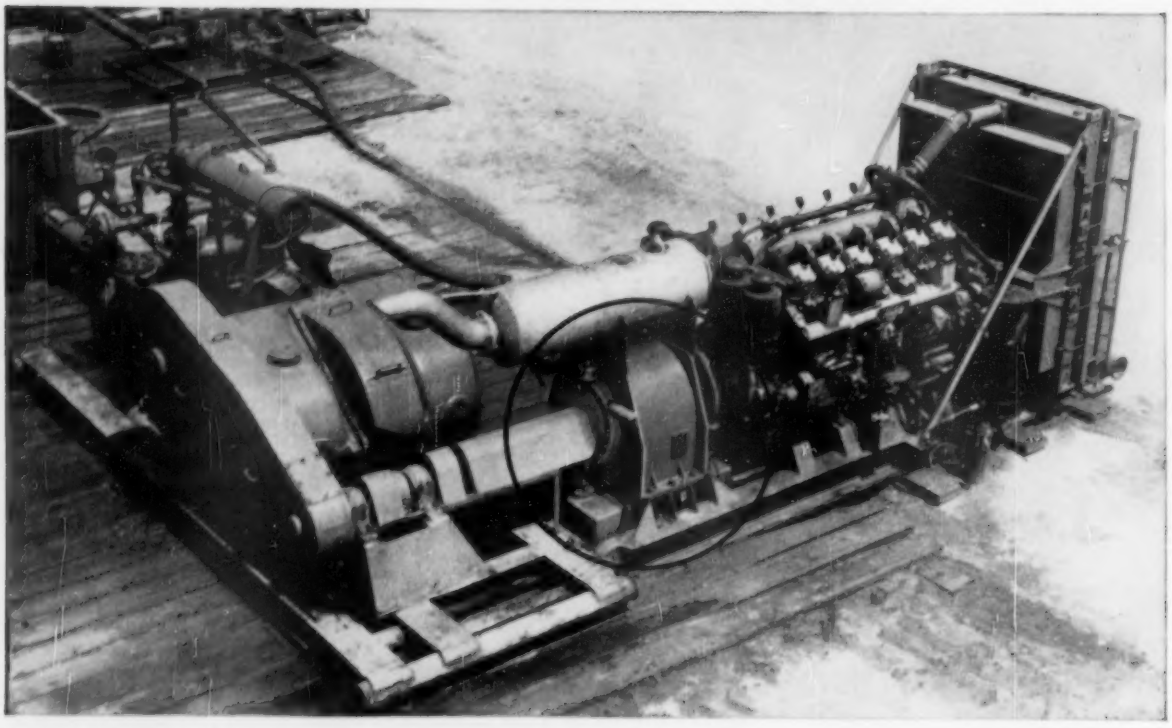
The term "Linde" is a registered trade-mark of Union Carbide and Carbon Corporation.

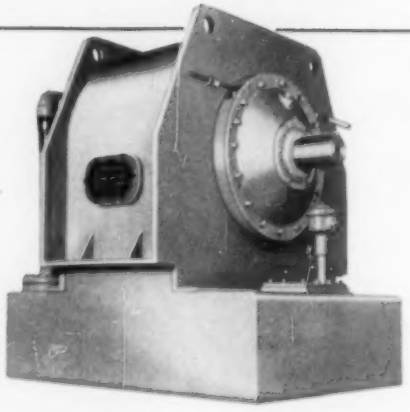


New American Blower Gýrol Fluid Drive smooths your rugged drilling operations

The American Blower Gyrol Fluid Drive means smoother power transmission for rotary, slush-pump, and draw-works operations. By simple regulation of the external control rod, you can start smoothly from a standstill against a full connected hoist load . . . supply adjustable, stable speed and power to the rotary table . . . or transmit smooth power from engine to slush pump at up to 96% efficiency.

The American Blower Gyrol Fluid Drive has no rigid mechanical connections to break under the strain of sudden shocks or over-loads. The vortex of oil acts as a liquid shearpin to prevent damage to engines or machinery.

Because of its excellent cushioning ability, the Gyrol Fluid Drive can be used effectively with any compound design, and provides great flexibility in manipulating pumps. Call your American Blower Office for full information, or write: American Blower Corporation, Detroit 32, Michigan. In Canada: Canadian Sirocco Company, Ltd., Windsor, Ontario.



Class 2F, Type VS Gýrol Fluid Drive. Stepless, shockless power from 280 to 820 hp, adjustable speeds to 1200 rpm.

AMERICAN BLOWER

Division of American-Standard

ALCO FLANGES...

Craftsmanship in steelmaking, forging and machining assures quality in the ALCO flange.

The ALCO flange is produced of high-quality carbon or alloy steel, made in ALCO's own furnaces. Steel production by the flange manufacturer lowers your welding, preheat and postheat costs because exact metallurgy is assured.

Forging and rolling techniques, drawn from ALCO's extensive experience, increase the quality of the ALCO flange. Metallurgical laboratories check metal characteristics through every step of flange production.

Finish and tolerances on the ALCO flange are provided by skilled machinists. You get flanges that fit right, work right in the job you assign to them.

The ALCO flange is available in a wide range of metallurgies to almost any specification. Fast delivery and prompt service on standard flanges are available from two locations, Beaumont, Texas and Latrobe, Pa. Sizes range from 18 in. up.

Contact your nearest ALCO Sales Office or write P.O. Box 1065, Schenectady 1, New York, for your copy of ALCO's 54-page catalog on Flanges and Welding Fittings.

ALCO **ALCO PRODUCTS, INC.**
NEW YORK
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ALCO PRODUCTS, INC., P.O. Box 1065, Schenectady 1, N. Y.
Please send me my copy of ALCO FLANGES AND WELDING FITTINGS.
☐ For reference ☐ For immediate project

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Company .....

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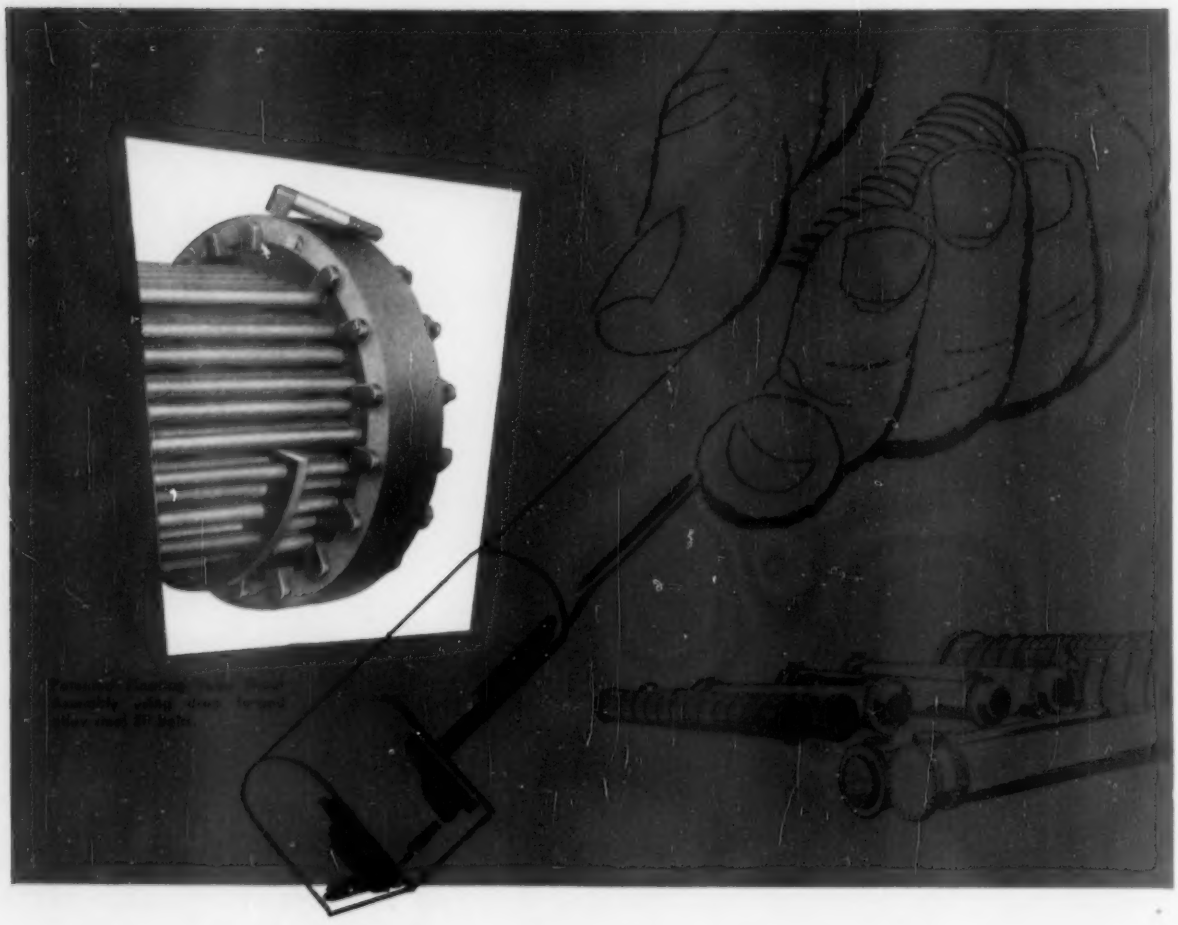

This Ell Bolt is the Key to leak control

The patented Ell Bolt construction employed on Vogt floating head heat exchangers is the answer to re-assembly without distortion or leak development.

Cover may be removed by simply loosening the Ell Bolt nuts and disengaging the Ell Bolt heads from the "lock notches." No misplacing of Ell Bolts can result — and tightening is easy and positive — absolutely leak proof. Send for Bulletin HE-6. Address Dept. 24A-XO.

HENRY VOGT MACHINE CO., P. O. BOX 1918, LOUISVILLE 1, KY.

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Vogt

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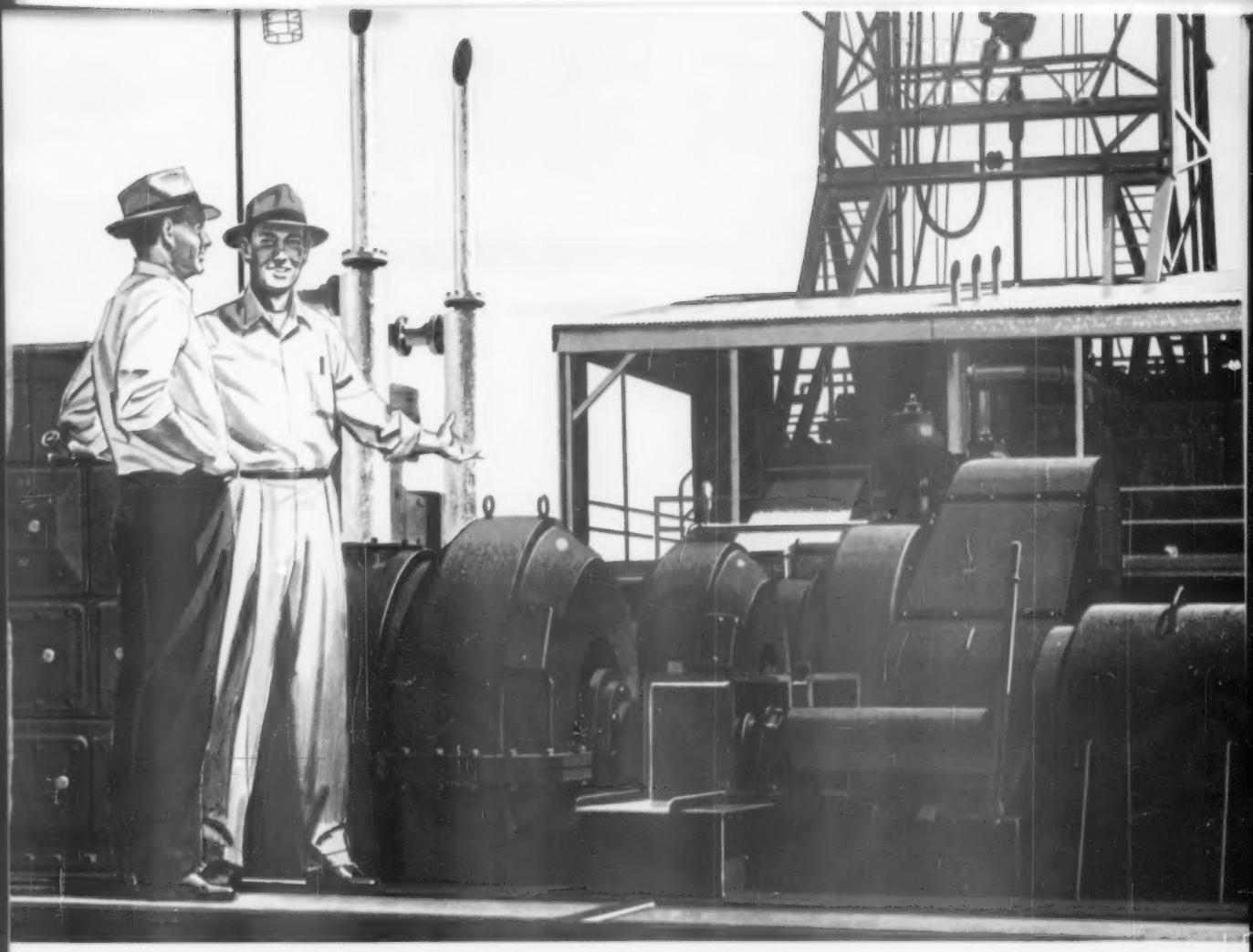
Drop Forged Steel Valves, Fittings and Flanges in a complete range of sizes • Petroleum Refinery and Chemical Plant Equipment • Steam Generators • Heat Exchangers • Ice Making and Refrigerating Equipment.

HEAT TRANSFER EQUIPMENT



"THEY SPEED TRIP TIME AND GREATLY EXTEND EQUIPMENT SERVICE LIFE"

This is a typical comment obtained from a recent survey of drillers using National Torque Converters. The customer* who made it owns six of them. He's using three on each of his two National Type 110 rigs that are also delivering good service.

Both rigs drill to depths of 12,000 and 13,000 feet, with drill strings weighing 260,000 and 280,000 pounds respectively. Overloads are common. But the owner says that in both cases, operations are smoother than with direct drive and less fatiguing for the operators. The National Torque Converters have cut 45 minutes from trip time near the bottom of the hole. Engines reach full throttle quicker.

Many other benefits are evident. The tool pusher and chief mechanic point out that the service lives of engines, clutches, chains, pumps, bearings and possibly also the wire lines, have been greatly extended by the use of National Torque Converters. One of the rigs has run almost continuously for thirty months without any repairs!

Outstanding service reports like this are common—not only on torque converters but on all National drilling and production equipment. Behind each one are many years of experience—20 years in hydraulic transmissions, for example—and a host of precision manufacturing techniques. You get the benefits of this experience whenever and wherever you do business with National. Remember, no oil field equipment or supply problem is ever too big for National to tackle—and solve to your satisfaction.

*Name and rig locations on request

THE
NATIONAL SUPPLY
COMPANY

GUARD AGAINST CORROSION FATIGUE FAILURES

with SPANG® "PLASTIC COATED" DRILL PIPE!

You can minimize the major cause of drill pipe failure—corrosion fatigue—by making sure that your next order of Spangweld or SPANG Double Seal Shrink Thread Drill Pipe has been "plastic coated" by SPANG's special process. Both types of SPANG Drill Pipe have been developed to withstand hard service and are highly resistant to fatigue and tension failures. Now, SPANG Plastic Coating adds longer drill pipe life where corrosive conditions are encountered.

On the opposite page, you can see how SPANG's high quality mill control standards assure maximum service of plastic coated Drill Pipe in the field.

For highly abrasive service conditions, Spangweld and SPANG Double Seal Shrink Thread tool joints are available with several types of hard facing.

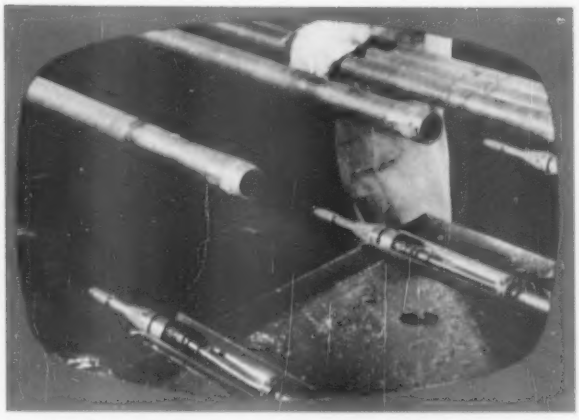
All of these features—top-quality SPANG Drill Pipe, SPANG Plastic Coating and SPANG Hard Facing—are outstanding reasons why you get maximum protection against failure when you specify dependable SPANG tubular goods. Why not talk over your requirements with the National Supply representative soon?

THE
NATIONAL SUPPLY
COMPANY

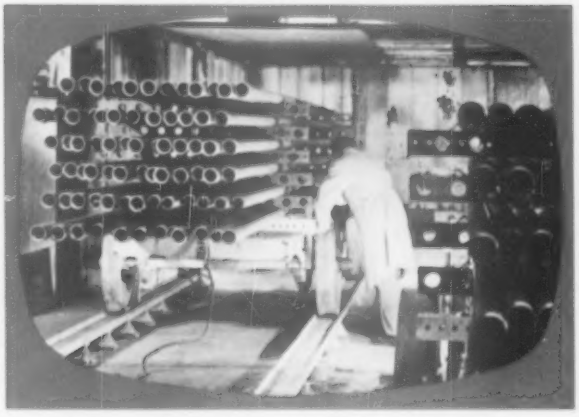
SPANG-CHALFANT DIVISION
MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
DIVISION TUBULAR OFFICES: Denver, Colorado; Houston, Texas; Ft. Worth, Texas; Los Angeles, California; Toledo, Ohio Tulsa, Oklahoma; Calgary, Alberta, Canada

NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

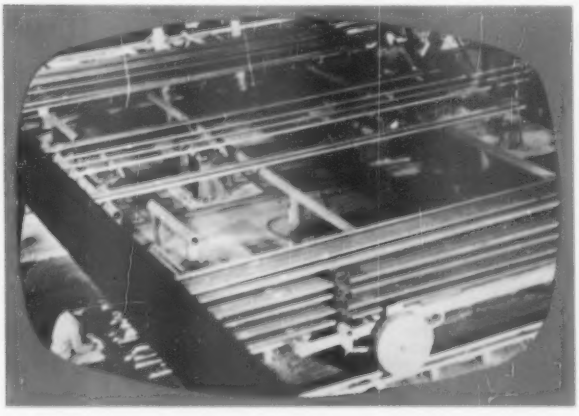
SPANG® "PLASTIC COATING" QUALITY CONTROL STANDARDS AT THE MILL ASSURE YOU MAXIMUM SERVICE LIFE



Special spray heads, working on a carefully-timed application cycle, apply multiple, uniform coats of tough plastic to a minimum of .005 inch thickness.

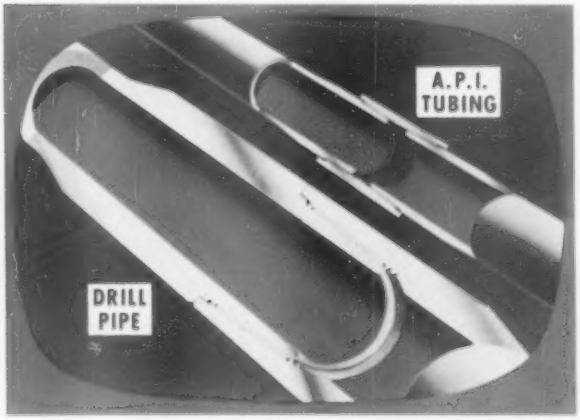


Between coatings, the pipe is "baked" to set plastic. This completely polymerized coating outperforms linings applied by ordinary methods.



Complete mill-controlled operations on orderly facilities assure high quality and maximum field service of Spang Plastic Coated Pipe.

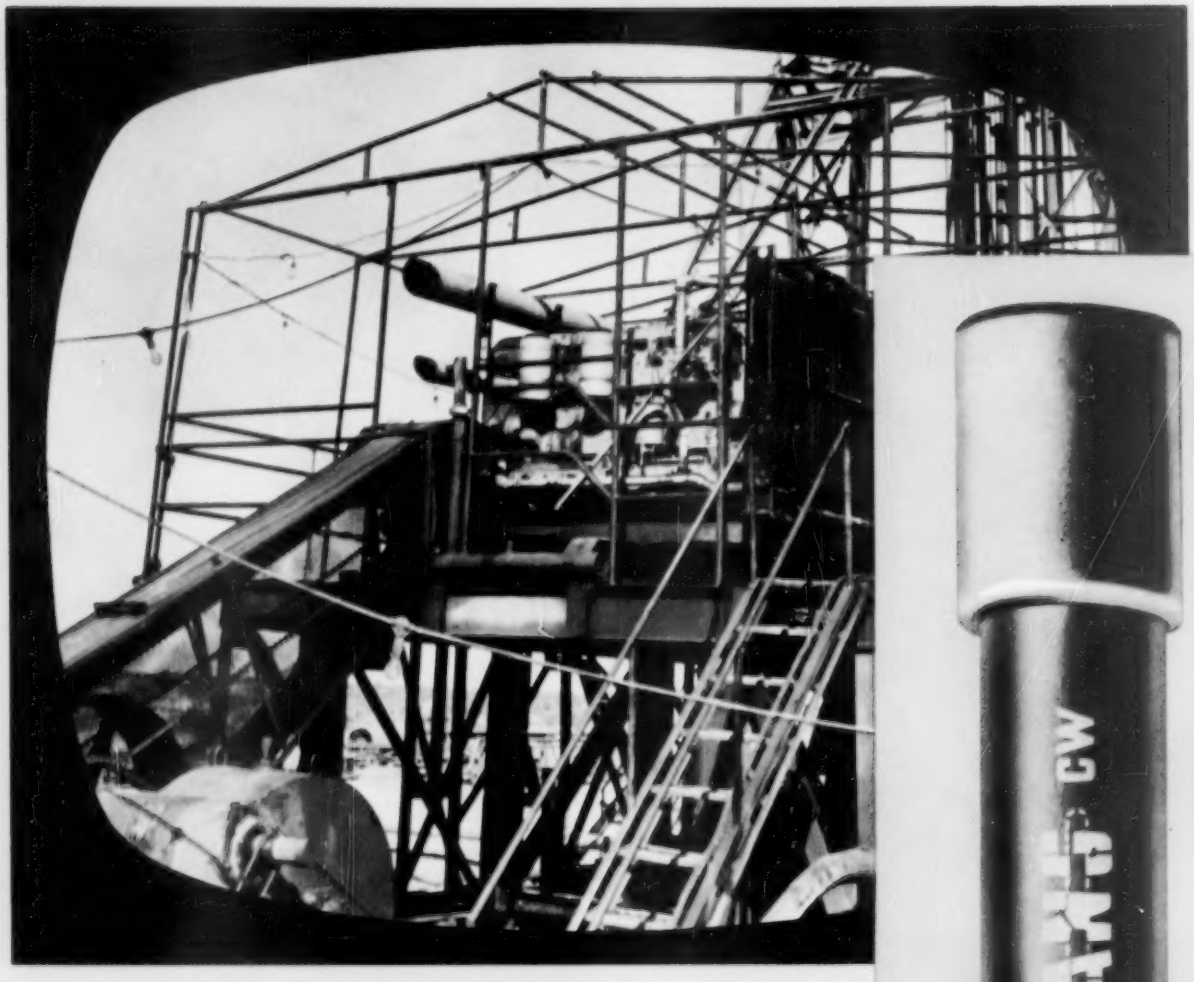
Magne-Gage inspection checks .005 inch minimum coating thickness. Smoothness, adhesion, chamfer coating and completeness of baking are also inspected.



Why not get complete details on this new Spang Plastic Coating service for your drill pipe and tubing requirements from the National Supply representative soon.

AND FOR
TOP QUALITY
GENERAL SERVICE PIPE

... See the next page –



SPECIAL QUALITY SPANG® CW PIPE SPEEDS GENERAL SERVICE WORK

The manufacturing care behind SPANG CW makes it fast to work with and install. Thorough tests and inspections before shipping insure its top strength and long service life—features that pay off wherever you put it to work.

In countless oil field applications, SPANG CW has consistently proved itself for dependable general service work. That's because it's made under close quality control conditions—like all the other famous SPANG oil field tubular products.

It is especially useful for water-flooding, air, gas and salt water disposal lines, water and oil gathering systems, as well as roof rails, step rails, etc.

SPANG CW Steel Pipe is available at every National Supply Store in a full range of sizes—and, most important, there's no extra cost for its special quality. Try it on your next job.

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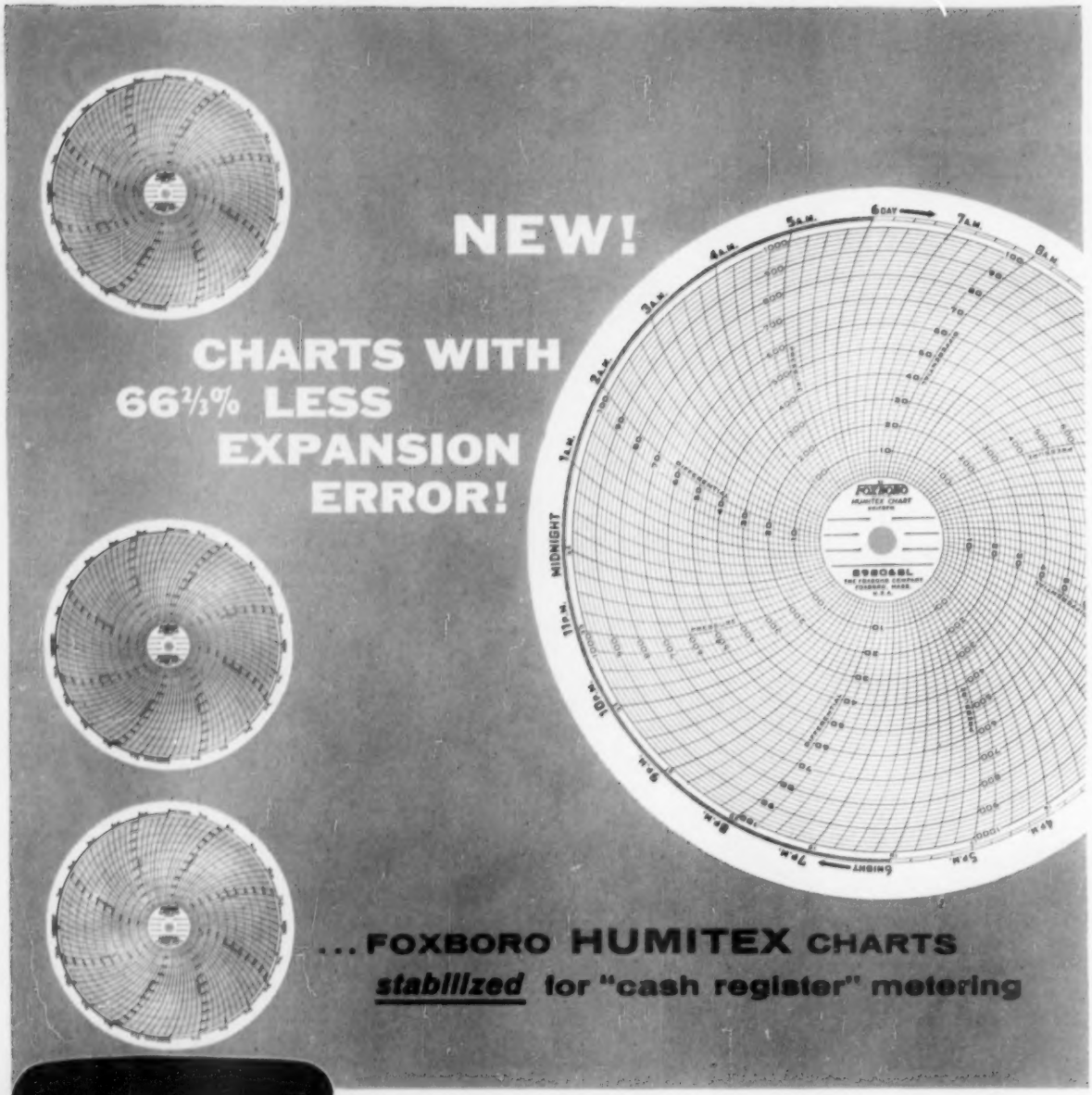
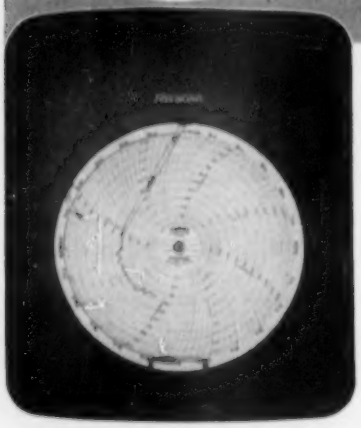
You have a place at every operation too! All of us oilmen—from exploration men like me to whatever you are—played an important part in the 9,131,545 surgical operations performed last year. We helped supply the doctors with germicides, anesthetics, antibiotics and many of the surgical accessories that help save lives. Unfortunately, too few outsiders know how much oilmen contribute to the health and happiness of the people. Are you doing everything you can to spread the word? It's to your advantage to have your industry understood and appreciated. **SHELL OIL COMPANY**





Like standard Foxboro Humitex Charts, these new *stabilized* charts have extra-high legibility too. Easy-to-read gray printing against the chart's smooth, white background brings out the full brilliance of Foxboro Recording Inks.

Here are the charts specifically designed to meet the high-accuracy requirements of "cash register" metering . . . Foxboro *stabilized* Humitex Charts. These advanced charts feature plastic-laminated paper — assure you *real* dimensional stability under the widest variations in temperature and humidity. In an extensive series of laboratory and field tests, Foxboro *stabilized* Humitex Charts were found to have only ¼ to ⅓ as much dimensional error as the highest grade of standard charts!

Foxboro *stabilized* Humitex Charts are your assurance of consistent, high-fidelity records — wherever you meter — wherever you compute. Try them at our expense. Write for samples and quotation. **The Foxboro Company, 6011 Neponset Ave., Foxboro, Mass., U.S.A.**

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

FOR MORE ACCURATE RECORDS **FOXBORO**

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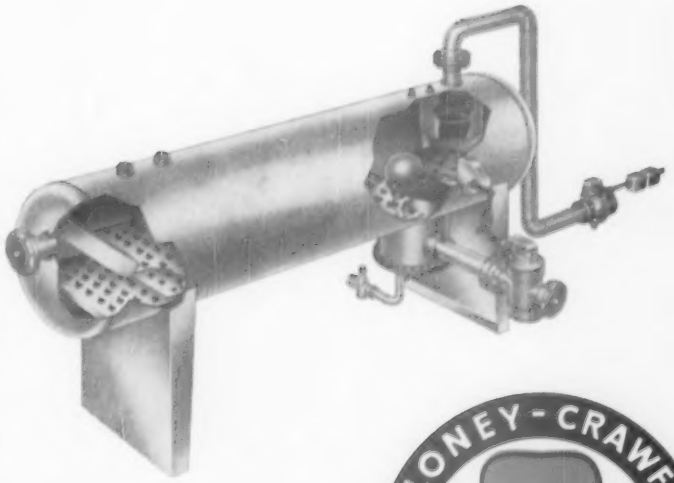
There's an Advantage to being HORIZONTAL

There are lots of advantages in using a Maloney-Crawford horizontal separator:

1. **It's easier to install**
2. **It's easier to service**
3. **It will usually handle more oil and gas than the same size vertical separator.**
4. **It will handle foamy oil**

Maloney-Crawford uses Fisher valves and controls, famous for reliability. M-C separators are available in all pressure ranges and sizes. They are easily made into any required size of packaged stage separation.

See a Maloney-Crawford representative before you buy a separator.



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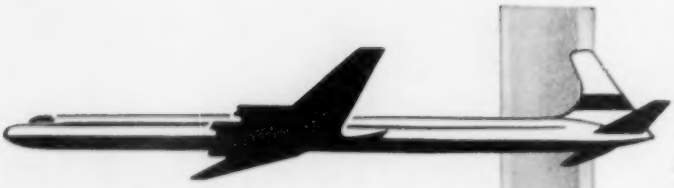
TEXAS PANHANDLE REPRESENTATIVE: Atlas Tank Company, Pampa, Texas

MALONEY-CRAWFORD TANK & MFG. CO.



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Golden Crown DC-7's daily between the U.S. and Havana, Jamaica, Caracas

The Royal Caribe leaves for Havana and Caracas daily from Chicago and New Orleans. There is also through-plane service from the West Coast via Delta and American to New Orleans. Fast connections from all points, coordinated to speed you to booming Cuba and Venezuela. Overnight connections in Havana for Super Convairs to Haiti, Dominican Republic or San Juan.

Royal DC-7 *Caribe*
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Fastest—most direct from:
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One of America's Pioneer Scheduled Airlines

Delta AIR LINES

GENERAL OFFICES: *Atlanta Airport, Atlanta, Georgia*

They Say—

Oil's Unequal Returns

"At this time the average depth of a well in our state (Oklahoma) is 4,000 ft. . . . To drill and complete this average well in Oklahoma it will cost about $40,000. The cost of producing that oil is about 96 cents per barrel. The average allowed production of that well, so far in 1956, is 25 bbl. per day.

"My figures indicate that there is a profit of about 75 cents a barrel before federal and state taxes. A well such as I described will yield $6,113.75 per annum. . . Taking the figures I have submitted, a period of over 6 years is required to return the capital cost of drilling and completing this 4,000-ft. well.

"Consider this, if you will, in an industry that puts back into the ground 60 cents of every dollar it takes out, looking for, and developing new reserves.

"Consider also, if you will, that this industry had its last price increase more than 3 years ago and that since that time steel prices and wages have gone up on four separate occasions.

"Today we are in dire need of corrective legislation in our industry, both on a local and national scale.

". . . There are those that would have us import as much as possible, in order that we may save the reserves in this country. Nothing could be further from the truth. If we cannot produce the oil we have found, then the capital is not available to explore for more. If we discontinue exploration, then our reserves will certainly soon be depleted."

Roy G. Woods, president, Oklahoma Independent Petroleum Association, before the Oklahoma City Junior Chamber of Commerce.

Oil's High Demands

"The oil business could use a compliment occasionally. For while it is one of the most important of America's industries, and perhaps above all the most progressive, it is also the most misunderstood. The popular stereotype too often sees the oil man as a fantastically lucky guy who makes millions with practically no effort . . .

"But . . . over the long pull there are few industries in America that make such heavy demands on energy, research, calculation, and sheer guts as does the oil business. It is a grueling, grinding business in which competition

You Need The Model MDH

LOW TEMPERATURE BS&B SEPARATION

COLD-FRAC* SYSTEM

When Your Gas Condensate Wells...

1 Are Extremely High Pressured

MDH COLD-FRAC Systems will give condensate recoveries comparable with more elaborate low temperature separation systems when the pressure reduction across the choke is sufficient to produce a temperature drop of 80° F. or more. This is normally obtained with inlet pressures of 4,000 psi or more and with the low temperature separator operated at approximately 1,000 psi or less. Special heat exchanger achieves maximum cooling with minimum pressure drop through counterflow with cold sales gas.

2 Produce Wax and/or Salt Water

The highly efficient BS&B Model DC Liquid Knockout is an integral part of the MDH COLD-FRAC System. It effects maximum scrubbing efficiency by removing particles 10 microns in size and larger. This inlet knockout handles the maximum rated gas capacity without carryover while handling a normal volume of liquid. Waxy oils and salt water are efficiently removed and bypassed around the heat exchanger and choke, eliminating operating problems and refrigeration losses.

3 Have A Pressure Life of 3 to 5 Years

MDH COLD-FRAC Systems are especially suitable for wells with a pressure life of 3 to 5 years, which normally maintains the proper balance between initial cost and added recovery. If the pressure life of the well is less than 3 years, the BS&B ECON-O-MAX unit should be considered; if more than 5 years, the GDH COLD-FRAC (with hydrate inhibitor) will insure maximum recovery throughout the extended life of the well.

Ask Your BS&B Representative For Details, Or Write To . . .

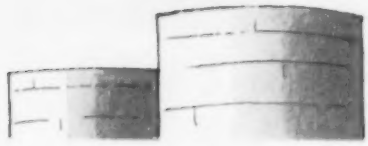
BLACK, SIVALLS & BRYSON, INC.

Oil & Gas Equipment Div., Dept. 1-A11

P. O. Box 1714 Oklahoma City, Oklahoma

✓ EVAPORATION

✓ EXCESS STORAGE



Cut these Costly Losses

with metered pipeline deliveries of crude direct to the working tank

- Recorded measurement of every barrel put through the line assures more accurate inventories
- By metering direct to the working tank, fluid levels are more constant, with minimum loss of vapor-laden air
- Weathering losses are minimized through lower storage requirements and shorter time exposure of crudes to temperature changes
- Simultaneous input and withdrawal from working tank means minimum need for expensive storage tankage

The high capacity, sustained accuracy, and low maintenance requirements of Brodie BiRotor Meters in pipeline service are daily demonstrating a new concept of efficiency in connection with tank farm, refinery and field processing installations. For the complete story, contact the Brodie Metering Specialist near you.

BRODIE BiRotor METERS

ALL STEEL — TRUE ROTARY

RALPH N. BRODIE COMPANY · San Leandro, California, U.S.A.

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REPRESENTATIVES WITH STOCKS AND SERVICE FACILITIES IN ALL PRINCIPAL CITIES

is fierce and mistakes are expensive. Yet it has contributed as much to America's industrial power and high standard of living as any other great business. Oil and gas now provide 66 per cent of the nation's entire energy demand.

"It is not simple to prosper or even survive in the oil business . . . In no other industry is there a greater premium on skill and brains . . . It's worth pausing once a year to give standing applause to our oil business and to the men who make it."

Editorial in the Tulsa Tribune.

Import Curbs Questioned

"The petroleum industry, along with the rest of our economy, has prospered under a competitive fuels system. The domestic producing industry should recognize that there is an obvious need, even today, for foreign oil—and that requirement will increase in the future. Consumer groups are already aware of this need.

"I do not question that costs of finding and developing domestic petroleum reserves have risen, or that these costs will continue to rise. What I do question is whether departure from a freely competitive fuels market—which the proposed restriction of imports would be—in the long run will: (1) be good for the economic welfare of the nation, (2) contribute at all to the national security . . . or (3) be good for the domestic petroleum industry itself."

David T. Staples, president, Tidewater Oil Co., before the California Natural Gasoline Association, Pasadena.

Hollywood Gusher Lingers On

"Hollywood has refused to admit that we don't have gushers today but the fact is they're long gone . . . and for the good of all. There's always an exception, though, and I notice that the Middle East had a whopper of a gusher just last month, the biggest the industry has seen in years. I thought it was appropriate that since it was the biggest, they had to send a Texan over to stop it, and even he was only partially successful."

R. W. McDowell, president, D-X Sunray Oil Co., in a speech before the Kansas City Oil Men's Club.

State Highway Headaches

"Nobody expected the 41,000-mile interstate highway network to materialize over night, although the taxes to pay for it certainly did. It's explained that perhaps 5 years will have to elapse

Use low-cost
CONCENTRATED
BORASCU®
WEED KILLER
wherever weeds and grasses are a FIRE HAZARD!

Your "grassing" costs can drop as much as 80% when you use this weed killer! Savings in man-hours alone can be impressive when you consider that year-long results come from just one easy, DRY application of powerful Concentrated BORASCU. This granular, inorganic herbicide **destroys** most vegetation and **prevents regrowth** for long periods because it **remains active** in the root zone; satisfactorily meets all your requirements for safety.

NOTHING TO MIX
NO WATER TO HAUL
NONPOISONOUS
NONCORROSIVE TO FERROUS METALS

Want details? Write... **United States Borax & Chemical Corporation**
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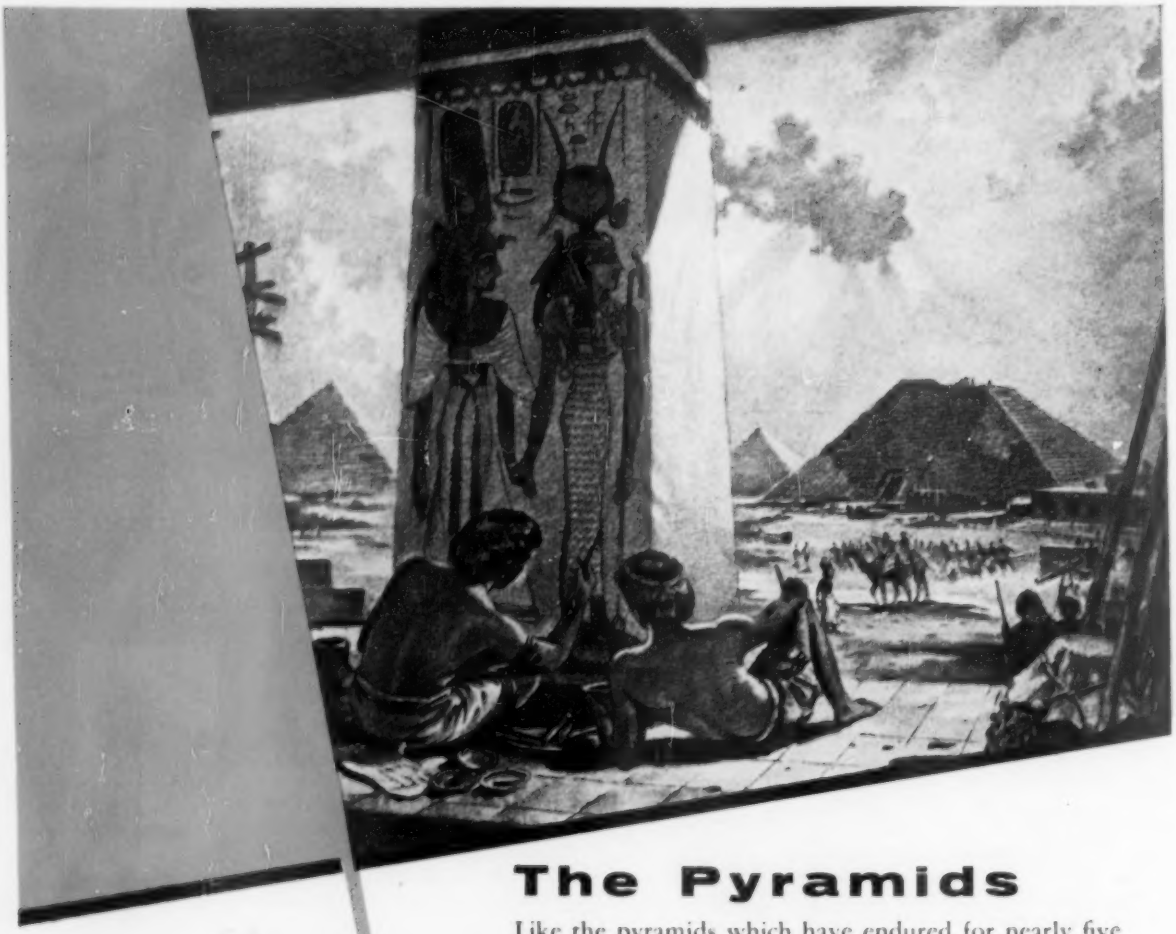

The Pyramids

Like the pyramids which have endured for nearly five thousand years, the Texas Employers' Insurance Association was built with strength to withstand any stress or strain and safeguard the interests of its policyholders.

Forty-two years of successful operation, through wars and depressions, have tested and proved the *Strength* of the Association. Today the Association is the leader in its field, with assets of $22,808,501 and surplus to policyholders of $6,844,353.

Last year the Texas Employers' Insurance Association paid $10,690,456 in settlement of claims and returned $3,855,678 in DIVIDENDS and GUARANTEED COST DISCOUNTS to its policyholders. Are you, like others in the Oil and Gas Industry, taking advantage of the SECURITY, SERVICE and SAVINGS offered by . . .

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A. F. ALLEN, *President*

before the results of the program become visible nationally.

"In the meantime all sorts of complications are developing . . . When the highway bill was before Congress the labor organizations succeeded in attaching a 'prevailing wage' provision that will handicap the states in trying to retain some measure of control over their own highway costs. In practice the 'prevailing wage' for any job classification is likely to be the maximum rate that the unions are able to establish. In addition to these rising wage costs there is the uninterrupted ascent of prices for all the materials and equipment that go into highway construction.

"The problem that confronts the states is how to program highway construction in view of these future cost uncertainties."

Editorial in the Oklahoma City Daily Oklahoman.

Meaning of Nationalization

"A nation has every right to take the private property of its own citizens to serve the common welfare. Our Government does the same thing in this country when it condemns property for a highway right-of-way. But the term 'nationalization' must not be used to mask acts of international irresponsibility, acts which destroy the integrity of international agreements in general.

"I hope . . . that you will not be misled and inclined to sympathize when you read that foreign holdings in one of the countries overseas have been supposedly nationalized. If those holdings are protected from expropriation for a given period by solemn agreements between governments and the investors—as most such holdings are—they cannot be subject to nationalization in the proper sense."

T. S. Petersen, president of Standard Oil Co. of California, in a speech to the New Mexico Petroleum Industries Committee in Albuquerque, N.M.

Dilemma of the U. S. Producer

"Canada has complained that limitations on availability of the American market constitute an unneighborly act and hamstring its comparatively new and growing oil industry. But American production never loses sight of the fact that its fixed allowable is far under its potential and that every increase in imports in effect reduces its output.

"The theory of proration for conservation of oil underground (in other words, nonproduction) is that petroleum should be brought to the surface only in amounts calculated to meet the market demand. It is into that available market demand that Middle East and other import oil cuts heavily. The con-

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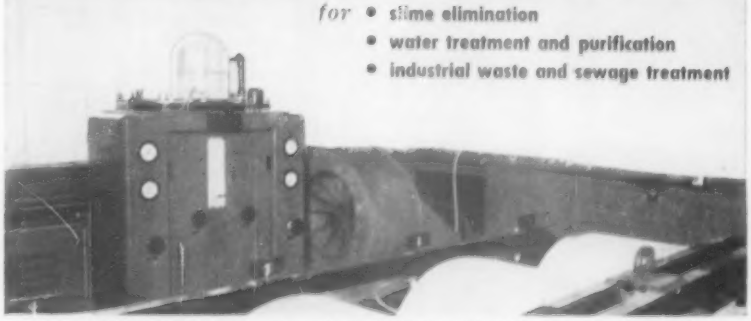

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cerned producer with no oil resources abroad asks simply what good it does his case to restrict Middle East oil and open the ports to hemisphere competition.

"Much of this import oil is American owned, so that all of the industry is not concerned in the economics of the matter. But it is a vital problem to the strictly intra-United States producer. He finds himself caught in a situation that involves foreign policy, honest conservation, domestic competition, and the necessities of alternate atomic fuel that might sweep away his entire market before he can realize on it."

Editorial in the Dallas Morning News.

Competition and Progress

"As for the oil industry I can assure you that competition has been a tremendous factor in accounting for the vast improvements in our products and in the processes by which we make them. I know that people are sometimes cynical about the claims of one oil company versus another as to the superior quality of its products—thinking that all the leading brands are about the same quality.

"The real truth, of course, is that vast improvements have occurred. One has only to consider the quality of gasoline today as compared with that of 10 or 20 years ago to understand this. You could not possibly run your modern car on the kind of gasoline we had then. If you tried it, the knocking in the engine would make it sound more like a machine gun than a means of transportation.

"What is also true, of course, is that because of competition every aggressive oil company is going to move heaven and earth to keep its competitor from getting very far ahead at any one time and, if possible, to get ahead itself. So, to the extent that other companies' oil products are almost as good as ours, for example, you can credit the result to competition."

S. A. Swensrud, chairman, Gulf Oil Corp., in a speech before the Tulsa Chamber of Commerce.

CALENDAR OF EVENTS

NOVEMBER

7-8 Instrument Society of America, Philadelphia Section, symposium on process data logging, Stratford Hotel, Philadelphia.

8 West Central Texas Oil and Gas As-

COLD facts about a HOT subject . . .

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● Decide right now to replace make-shift heating facilities this winter with clean, safe, dependable Stewart Stoves.

Equipped with regular Stewart Hi-Efficiency B-4 gas burners—"The Burner without an equal" — Stewart Stoves provide plenty of heat at low cost, for derrick floors, warehouses, supply stores, garages, industrial plants, etc.

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Natural gas stoves furnished with gas valves, pilot light and pressure regulator. Butane stoves do not have pilot light and pressure regulator.

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Most natural gas contains moisture, carbon dioxide and hydrogen sulfide. Costly corrosion of lines and equipment will result unless the gas is effectively dehydrated. The surest way to insure complete dehydration is with ALCOA Activated Alumina—the oldest, most thoroughly proved commercial desiccant available.

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It will pay you to get complete information about this sure cure for a major corrosion headache. For detail data on the properties and performance of the various grades of ALCOA Activated Alumina, write to ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 715-L Alcoa Building, Pittsburgh 19, Pa.

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ALTERNATE SUNDAY EVENINGS

sociation, annual technical and membership meeting, Hotel Wooten, Abilene, Tex.

8-9 American Association of Oilwell Drilling Contractors, eleventh annual drilling safety clinic, Statler-Hilton Hotel, Dallas.

8-9 American Association of Petroleum Geologists, Society of Exploration Geophysicists, and Society of Economic Paleontologists and Mineralogists, Pacific Coast Joint Regional Meeting, Ambassador Hotel, Los Angeles.

8-9 Society of Automotive Engineers, Inc., national fuel and lubricants meeting, Mayo Hotel, Tulsa.

12-15 American Petroleum Institute, thirty-sixth annual meeting, Conrad Hilton Hotel and Palmer House, Chicago.

13-14 University of California, National Association of Corrosion Engineers, short course on underground corrosion, Lafayette Hotel, Long Beach, Calif.

15-16 National Association of Corrosion Engineers, Western regional division conference, Lafayette Hotel, Long Beach, Calif.

19-20 American Institute of Mining, Metallurgical & Petroleum Engineers, North Texas Secondary Recovery Symposium, Municipal Auditorium, Wichita Falls.

25-27 Kansas Independent Oil and Gas Association, nineteenth annual meeting, Broadview Hotel, Wichita.

25-30 American Society of Mechanical Engineers, Statler Hotel, New York.

26-28 Conference on Solvent Extraction, sponsored by Oklahoma A.&M. College, Stillwater, Okla.

30 Natural Gasoline Association of America, Panhandle-Plains regional meeting, Herring Hotel, Amarillo, Tex.

DECEMBER

3-4 New Mexico Oil and Gas Association, annual meeting, Alvarado Hotel, Albuquerque.

6-8 Interstate Oil Compact Commission, annual meeting, Fontainebleau Hotel, Miami Beach, Fla.

9-12 American Institute of Chemical Engineers, annual meeting, Statler Hotel, Boston.

11-12 Water Quality Control for Subsurface Injection, conference sponsored by the University of Oklahoma, Norman, Okla.

1957

JANUARY

14-16 Pipe Line Contractors Association, ninth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

14-18 Society of Automotive Engineers, annual meeting, Sheraton-Cadillac and Statler hotels, Detroit.

21-55 American Institute of Electrical Engineers, 1957 winter general meeting, Hotel Statler, New York City.

FEBRUARY

13-15 National Association of Corrosion Engineers, Tulsa section, eighth annual short course for pipeliners, Hotel Mayo, Tulsa.

17-18 Engineers, Joint Council, Statler Hotel, New York.

22 Natural Gasoline Association of America, Permian basin regional meeting, Scharbauer Hotel, Midland, Tex.

24-28 American Institute of Mining, Metallurgical and Petroleum Engineers, annual meeting, Hotels Roosevelt and Jung, New Orleans.

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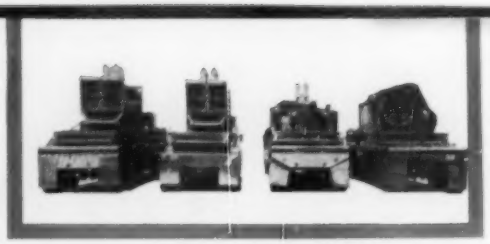

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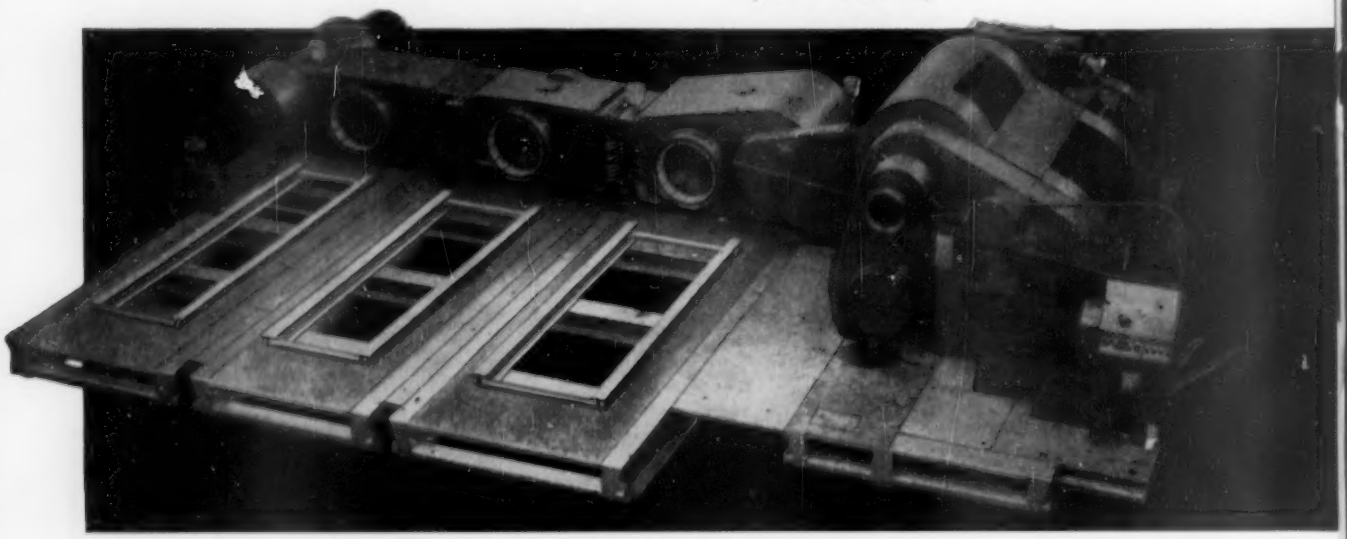

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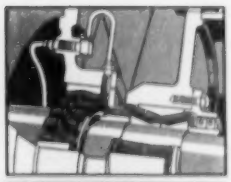

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TULSA, OKLAHOMA

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JOURNALLY SPEAKING . . .

Seismic Game

ON the theory that anybody in the "oil game" just naturally likes to play games, we've got a dandy game in this issue.

No kidding, it actually is a game. It's on those green pages following page 96. It's one of those true-or-false games, sort of like an intelligence test. It's designed to test your ability as an oil finder, particularly your ability to find oil by geophysics.

We stuck it in this issue as a way of tipping our hat to the annual meeting of the Society of Exploration Geophysicists—which is fair enough considering that most of the dope came from the S.E.G. in the first place.

Only instead of presenting the dope the same way the S.E.G. did, we fixed it up real tricky. So tricky, indeed, that our presentation, art, and mechanical departments had many a huddle over how to do it. And what did they come up with? Half pages. Who ever heard of a magazine printing umpteen and a half pages? But our boys did it. Maybe we should claim another "first" for the Big Yellow Book.

Now the question arises: How many pages are there all together? There are 10 full pages and 4 half pages. If you count only the full pages it's a 10-page section. If you count the half pages as full pages, it's a 14-pager. If you take the half pages at their face value it's an even dozen. It's got us stumped.

The purpose of the half pages is to make you play the game without cheating.

It works like this: Suppose you want to see if you are smart enough to have discovered Elk City oil field. First you study the seismic map. Then you read the little blocks of type to the right. Then you lay the half page down over the answers and check off your answers to the questions in the last column. Then flip up the half page and grade your own examination paper.

If you win this game you don't get any prize from us. Your prize is the knowledge that you can go out and find yourself an oil field any time you feel like it.

If you don't like games, or don't like your education served up in capsule form, you can always buy the S.E.G. book from which this was digested. But we figured that so many people would like this seismic check-game that we had some extra copies printed up. While they last, our Reader Service Department will supply copies at a very modest charge. No box tops required.

Conversation Piece

WE don't know how we would fill up this column if it weren't for letters from people like A. T. Bennett of Pittsburgh, the old pipeline right-of-way man, who can recall enough amusing experiences to make a book. For example, here's one about an old farmer he "ran into" one day:

Once while buying right-of-way in a hilly section of the country with mostly unimproved roads, I happened to be moving along in my car at a pretty good clip. It was in the fall, and we had already had ice on the puddles several nights.

Not being too familiar with the road, I came over a sharp rise and had to slap on my brakes. As ice had formed in the road, I cut a dido, went through a fence, and wound up tight between two nice apple trees in an orchard. I was as tight between them as a country ham sandwiched between two slices of bread.

I got out and went to the farmer's house to get help, and ran into a fine old gentleman. I explained what had happened and asked if he had some horses to pull me out. Sure, he said, but it would only take one horse. I had my doubts, but we got the horse and returned to the car. When he saw how tight I was locked in between the trees he returned and got another horse and we snaked her out.

We both returned to his house and while thanking him I asked what I owed him for use of the team, his time, and to repair the fence.

"Nothing," he replied. I started to insist, but he wouldn't take anything.

"Son," he said, "that danged fence ought to have been repaired long ago, and now I have to do it. I've been too lazy to exercise the horses, but today I had to. And your skidding and winding up in the orchard will give me something to talk about in the general store all winter. So I'm very glad to have met you."

—*Henry D. Ralph.*

Heard over a supply store counter...

"You mean it actually costs less to run casing with FLEXIFLOW?"

"That's right... because Flexiflow fills the casing automatically as it is being run, you save the time required to fill the casing at the surface. And what's more, you can run casing at a faster rate, without fear of damaging the formation with high-pressure surges. With Flexiflow, casing running times can be reduced by as much as one-third. That's why it costs much less overall to run casing with Flexiflow."

Flexiflow's Flexible Flow-Control Diaphragm *automatically* adjusts itself to compensate for increases in pressure—automatically relieves harmful pressure surges before they can act on the formation. The higher the pressure from below, the more the hole through the diaphragm expands. And after the first few joints of casing have been run, the hole expands to the point where a joint is filled as each new joint is run. This, of course, is the condition that provides maximum relief from pressure surges (Ram effect). After each joint is run, the hole returns to its original diameter, controlling the fill and preventing overfill of the casing.

Another very important fact about the pressure-relief provided by Flexiflow, is that, in addition to minimizing the danger of breaking down a potential lost circulation zone and setting up a possible bad cement job, the chances are very good that you are at the same time *protecting the producing life of the well.* Pressure surges, created by the use of conventional floating equipment under certain conditions, drive a portion of the well fluid into the formation and tend to "mud-off" the producing zone. This can seriously cut down the production of a well. By using Flexiflow to relieve these pressure surges you are actually protecting the producing formation.

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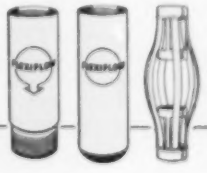

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BAKER FLEXIFLOW

What it will take to get higher oil prices

IT ought to be obvious to everybody in the industry that prices of crude oil and refined products are not going to go up in the near future, despite the pinch of sharply rising costs.

It ought to be equally obvious that the reason is oversupply and excessive inventory. Although demand has increased nicely for several months and has been ahead of 1955 all year, crude supply, crude stocks, refinery runs, and products stocks have all been too high.

So it ought to be entirely obvious that the industry's No. 1 problem is to work down its excess inventories. It will take a good many months to do this, but it must be done before there is any hope of getting prices up in line with present costs.

THE MOST RECENT REMINDER of this is the report of the I.P.A.A. supply and demand committee, which said "inventory imbalance will be a significant factor affecting the demand for crude oil, refinery runs, and yields during the next 6 months." It might have added "and prices," but this should be self-evident.

Next year, forecast this committee, domestic demand will go up 4.6 per cent. But new supply needs to increase only 2.7 per cent if inventories are drawn down to proper levels. If supply is not held to that figure and if inventories are not reduced, there can be no basis for a firming price structure.

This has been going on for years. Sometimes an unexpected event—severe weather, an international crisis, a refinery strike—bails out the industry. But then competitive enthusiasm starts the cycle again.

INVENTORY MANAGEMENT is an art that few industries have mastered, but many come nearer to it than oil. The automobile industry is a recent and striking example. During the past 6 months it managed to work off what threatened to be a disastrously large stock of 1956 cars, and so can get higher prices for the 1957 models.

Oil can do the same, but it will require some 6 months of planning and waiting. The peak demand for all oils will come in January or February. This could work off the burdensome inventories provided that, in the meantime, crude supply, refinery runs, and yield patterns—all three—are geared to that objective.

The job can't be accomplished by complaining that the fault lies with somebody else for importing or producing or refining too much. The industry's over-all failure to cope with its inventory problem is an indictment of its managerial ability and a standing impediment to a realistic price structure.

If the industry wants higher prices by next spring it must spend the interim working seriously to get down stocks of crude and products.

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Current and significant in . . .

The Industry This Week

Middle East Crisis

• **Oil now looms as a prime weapon** in the boiling Middle East crisis, precipitated by British and French military action in Egypt. It also may become a prize commodity if the Suez Canal is closed for a long time because of a vessel sunk in the waterway.

Questions awaiting an answer this week are:

. . . **Will Washington drop plans** to aid Britain and France with emergency supplies of oil?

The U. S. last week suspended all activities of Middle East Emergency Committee which had program ready to supply Europe if Suez closed.

Suspension of M.E.E.C. activities probably will not be prolonged. Even if Britain and France are left to find their own oil supplies, as some suggest, U. S. likely will move to aid other Europeans if shortages arise.

. . . **Will Arab oil-producing countries** shut down industry? Egypt's Nasser has asked them to close in the wells and halt oil movements over two vital pipelines to Mediterranean.

Industry

• **Oil has bigger stake in elections** this week than most U. S. industries. It is increasingly becoming more involved with Government. Hence, how the next President views oil is becoming more important. P. 60.

Processing

• **Processing by atomic radiation** is nearer than most people think. Reactors now being built for power will give a quick source of radiation. Oil companies are advised to start their basic research now to get the know-how that will put them on the ground floor. P. 70.

Octane ratings of U. S. gasolines are still climbing. Latest report shows premium grades average 97.1 and regular 90.2. P. 69.

Pipelining

• **Contracts have been awarded** to three companies and work already has begun on Texas Eastern Transmission's 422-mile, 30-in. line from McAllen to Beaumont, Tex. The artery will bring Mexican gas to Texas Eastern's main system. P. 73.

Production

• **Free-world production** has reached a record 15,130,100 bbl. daily. Chief causes: A 105,000-bbl. daily rise in U. S. output and a 52,800-bbl. daily jump in other Western Hemisphere countries. P. 84.

Unitization of Rangely field, Colorado's largest, is believed nearer than at any time in last 10 years. Operators are studying new plan submitted by The California Co. Phillips Petroleum Co. also is reported conducting preliminary studies on water-flood project for the field. P. 68.

Exploration

• **Offshore leasing in Persian Gulf** promises to be a blue-chip affair. Indications now are the coming scramble for acreage will make payments made for underwater lands on the U. S. Gulf Coast look like penny-ante play. P. 81.

Syrian oil strike is being deepened by American J. W. MenHall whose wildcat added that Middle East country to world's producing nations. Location is in northeastern Syria 25 miles from Ain Zalah field in Iraq. P. 85.

Newcomer to Venezuelan oil play, Star Oil Co., has bid a record price for concession. Star's bid was $1,965 per acre for 21,400-acre concession in the Mara field. P. 85.

OIL'S POLITICAL BOX SCORE

The oil industry's stake in this week's election is biggest of any U. S. industry. Here's what oil men can expect from the winning presidential candidate for the next 4 years.

	IKE	ADLAI
NATURAL GAS	Favors lifting price controls from producers if consumers protected.	Might ease price controls if convinced they stifle production.
IMPORTS	Still wants voluntary controls.	Uncommitted on course of action.
DEPLETION	27½ per cent allowance safe.	Might cut it to plug tax "loophole."
TIDELANDS	Both in same boat: Will insist on 3-mile limit to state offshore boundaries.	

How Next President Views Oil

Bertram F. Linz
Washington Editor

AMERICAN voters this week are deciding what kind of government they want in Washington for the next 4 years. The oil industry has a big stake in the outcome—probably as much as any other industry.

Oil men have learned what to expect from Dwight D. Eisenhower since he took office January 20, 1953. They believe they can project his views in charting their course for 4 more years of Republican rule. Stevenson also has hinted in broad terms his views on a few vital issues affecting oil.

But the big question mark will be Congress. Here the party label has become almost meaningless. Geography is more important than party.

Oil on the spot . . . Involvement of the oil industry so deeply in politics is a postwar trend. It stems from twin factors:

. . . Leasing. The industry deals directly with the Government on such matters as oil and gas leases on public and Continental Shelf lands and in meeting military requirements.

. . . Regulations. The industry has become clothed with public interest. Administrative policies thus have become vastly important in determining federal controls over natural gas, oil imports, tax incentives, research. It also makes oil an easy target for advocates of further control.

One blessing . . . The Eisenhower-Stevenson campaign luckily closed out without oil becoming a political football.

This is an unexpected blessing. There were indications last spring oil might become one of the outstanding issues of the fight for office. President Eisenhower had vetoed the Harris-Fulbright gas bill with a blast at the tactics of a "very small segment" of the industry. That set off a highly publicized Senate committee investigation of the industry's activities on behalf of the measure.

But neither party platform mentioned oil or gas specifically. And neither candidate touched on them during the campaign.

The Congress . . . Make-up of the next Congress actually will be as important as that of the administration but for a different reason.

The division on bills such as the Harris bill has become geographic rather than political, pitting the consuming states against the producing states.

A number of congressmen who voted for the Harris bill in the last Congress already have passed out of the picture. Others will be defeated for reelection. Passage of a gas bill next year will depend on how many friends the industry can make among the delegations from the consuming states which outnumber those from the producing areas.

Major role of the White House in battles such as this is the kind of proposal it sends to Congress and the position taken when bills reach the President for signature.

Actually the hard economic facts of a situation might call for identical decisions by Eisenhower or Stevenson—no matter which is in the White House. But the two are vastly different in basic thinking. Here is how those differences may add up in the treatment of oil:

Business Philosophy

If Eisenhower is returned, the policies laid out over the past 4 years will retain their vitality. He will continue to look to private initiative and private capital to generate the forces for economic expansion and broadened prosperity.

Full success of Eisenhower's policies, however, may be limited by a Congress which stops short of giving him full support. Few expect the Republicans to win control of Congress. But during the past 2 years a Democratic-controlled Congress gave the President good support on oil matters. Thus maintenance of good relations between the Capitol and White House will be important.

Government policy, naturally, will change if Stevenson is the winner.

EISENHOWER

STEVENSON

More reliance is expected to be placed on the power of Government as the force to generate expansion and prosperity. In pressing his policies Stevenson likely will have the support of a Democratic Congress.

Natural Gas

Congress will get another bill next year to release independent gas producers from federal price control.

If Eisenhower encourages the bill—and he indicated last February he would—it will be easier to pass. The President has warned, however, Congress must write into the measure some protection for consumers.

Stevenson has never gone firmly on record on the issue of regulating the natural-gas industry.

But he indicated some months ago that he would be receptive to a Harris-type bill if convinced that federal regulation was stifling producers and curtailing supplies to consumers.

Supporters claim Stevenson would sign a bill that meets his own ideas of how the industry should operate.

Tidelands

The Republican administration returned the tidelands to the states in 1953. The law, however, did not define seaward boundaries of the Gulf Coast states.

If Eisenhower returns, there will be no change in the Justice Department's theory that all states are limited to a 3-mile boundary. The suit against Louisiana will, of course, be pressed. If the department wins, the effort will be extended to Texas and Florida.

Stevenson has expressed himself bluntly on the tidelands issue. His position is this: Congress passed a bill restoring the offshore lands to the states. The Supreme Court refused to overturn it. So it is now the law of the land. But Stevenson has let it be known he would not ease up in the effort to make federal holdings of all submerged lands beyond the 3-mile limit.

Synthetic Fuels

The Government stepped out of synthetic liquid-fuels research last year. Eisenhower intends to keep it out. This is one of the matters the administration believes can safely be left to private enterprise.

This research might well be revived under Stevenson. Sen. Joseph O. O'Mahoney of Wyoming has indicated that he will press for a big research program. He believes the job can be handled by the Government better than by industry.

Imports

Oil imports will again be a live subject in Congress next year.

Eisenhower will continue to resist efforts to apply rigid government controls. He may even find himself at odds with Congress over the issue. But if the problem can't be solved by voluntary action of importing companies, Eisenhower may face two alternatives: Take action under the trade agreements law or accept a quota plan handed him by Congress.

The oil imports problem won't become any less pressing with a change of administration. The same questions of our relations with the Middle East countries and our international trade policy will be raised. The demand of domestic producers for limitations will not be quieted. Stevenson will be faced with the same alternatives that may be offered Eisenhower.

Depletion Allowance

Under Eisenhower, the industry's 27½ per cent depletion allowance is not likely to be singled out for attack.

The Treasury has had depletion "under study" for 4 years. Secretary Humphrey has never expressed himself on the propriety of the rate. But he has said depletion is necessary as an incentive to exploration and development.

Eisenhower probably will not ask Congress to reduce taxes next year. He may recommend some changes, such as relief for small corporations, but has indicated that he feels a cut in taxes generally must be deferred until the Treasury is in better position to absorb the loss of revenue.

Tax reductions would be more likely under Stevenson. So would action to close loopholes in the tax laws. A considerable number in Congress call the industry's allowance a loophole and would like to see it reduced. A Democratic Treasury might go along with that idea to get funds to recover losses from a reduction in individual taxes.

One feature of any tax bill next year will be relief for small corporations. To give that it might be necessary to shave the present corporate rates generally. But Stevenson is represented as less likely to be sympathetic to cutting taxes for big corporations which are showing high profits.

Public Lands

The Eisenhower administration will not willingly give up its plan to grant oil and gas leases on wildlife refuges. It will insist, however, that all operations be carried on in a way that will not lessen their value.

Interior Secretary Fred A. Seaton has reflected Eisenhower's philosophy in holding that development of the refuges is in line with prudent, common-sense management.

There could be some change in policy on wildlife refuge leasing under a Democratic administration. But it seems unlikely now that the issue will be raised. If it is, however, Stevenson might go along with new restrictions on leasing to satisfy the conservationists.

Monopoly

Further efforts to stiffen the antitrust laws are expected to be made in Congress. The administration will not go along willingly on any strong repression of competition. But Eisenhower might accept measures limited to specific antimonopoly problems.

The Democrats in Congress have taken the lead in efforts to strengthen the antitrust laws. Stevenson is expected to be responsive to their efforts. Such a move fits with his concept that big business should be curbed in order that small business may grow.

A record 1,471 registered for the I.P.A.A. meeting. This is the Monday luncheon scene.

I.P.A.A. Hears Conflicting Gas Views

DALLAS.—An apparent conflict between producers and other segments of the natural-gas industry over basic principles of new legislation to replace the vetoed Harris-Fulbright bill was evident in public statements at the I.P.A.A. annual meeting.

The association's natural-gas committee brought in a resolution reiterating its stand against any form or degree of federal regulation of field prices or curtailment of freedom of contract.

The committee argued that any contract made in good faith by arm's-length bargaining should be acceptable, and opposed outlawing favored-nation and other types of price-escalation contracts.

A contrary view was taken by James F. Oates, Jr., chairman of Peoples Gas Light & Coke Co., Chicago, a gas distributor and parent company of Natural Gas Pipeline Co. of America and of Texas Illinois Natural Gas Pipeline Co.

Oates outlined his recommendations for new legislation in an address to the meeting. One of his principal points was that favored-nation and other indefinite price escalations be outlawed and that certain types of price increases be subject to review and revision by the Federal Power Commission.

Informal discussions . . . However, informal and private conversation suggested that the two views are not necessarily irreconcilable.

It was common knowledge among those at the meeting that for the past several weeks there have been discussions between informal groups of producers, distributors, and pipeliners in an attempt to outline a new bill which would be acceptable to all.

While nothing was said publicly about the progress of these negotiations, there was a general hope that the opposing viewpoints could be compromised in a satisfactory manner.

Oates' recommendations . . . Oates told the independent producers that in spite of the good arguments for complete exemption of the gas producer from any form of federal supervision or regulation, "such a result cannot reasonably be expected.

"I believe that it is far more realistic to seek through cooperative effort to develop a satisfactory amendment under which all segments of the industry can coexist at peace and with economic well being."

Oates' points for inclusion in a new law were:

. . . Irrebuttable acceptance of specific prices in arm's-length contracts made before June 7, 1954 (date of the Supreme Court's Phillips decision), including step escalation, tax adjustment, or similar provisions for identifiable increases, but not spiral or automatic favored-nation escalators which leave the price increase uncertain and beyond control of the immediate parties.

. . . Automatic and uncontrolled escalations banned in contracts made after June 7, 1954, but contracts without such would go into effect within a specified period after filing with FPC unless there is objection.

If there is objection to a new contract, or to a price increase under a favored-nation escalation in an old contract, FPC to set the reasonable market price based on commodity value and other factors to be spelled out in the law but not including the public-utility basis of original cost.

. . . No "escape clauses" or producer's option to stop service before the end of the contract because of dissention with FPC regulation.

. . . Pipeline-produced gas to be given a reasonable market value the same as applied to independent producers in contested cases.

. . . Prices paid for gas under valid contracts to be included in pipeline rates without question.

. . . Certificating, reporting, and accounting requirements for producers to be held to the barest minimum required for application of this regulatory scheme.

Oates said that he believes that these princples can be drafted into legislation which will meet the requirements of the President's veto message that new legislation include specific language protecting consumers.

1957 Demand to Be Up, I.P.A.A. Says

DALLAS. — Domestic demand will average 9,320,000 bbl. a day in 1957—a 4.6 per cent gain over 1956.

This is the forecast of the supply-demand committee of the Independent Petroleum Association of America, presented here last week at the association's twenty-seventh annual meeting.

Total demand, the committee said, will be up somewhat less—4.3 per cent—since exports are expected to show a further decline. The conclusions were based on these assumptions:

. . . Business activity will be slightly higher next year.

. . . Middle East movements will not be interrupted.

. . . Normal weather will prevail.

What these demand figures will mean to the domestic producer, though, will depend primarily on what, if anything, the Government does about imports.

If imports next year are no higher in relation to domestic output than they were in 1954, the committee said, U. S. oil men will be called on to produce an average of 7,500,000 bbl. daily.

But if imports increase at the same rate they have this year, it warned, demand for domestic crude will be only about 7,100,000 bbl. daily—about the same as in 1956.

Stocks are worrisome . . . There'll be no need to add to product inventories at all next year, the group concluded.

At present, they are well out of balance. Gasoline stocks, for example, in mid-October totaled 173,000,000 bbl., a 14 per cent gain over the figure a year earlier.

Gasoline isn't the only culprit. While stocks of gasoline were rising 21,500,000 bbl. during the year, stocks of all other products rose almost 30,000,000 bbl. Together they climbed at a rate of 140,000 bbl. a day.

"Inventory imbalance will be a significant factor affecting the demand for crude oil, refinery runs, and yields during the next 6 months," the committee said

New supply needs . . . The need to correct the inventory situation means that the volume of additional crude to be required will be less than the increase in demand.

Total new supply required was estimated by the committee at 9,637,000 bbl. daily, an increase of only 250,000 bbl. per day. This is a gain of 2.7 per cent, compared with a total-demand increase of 4.3 per cent and a domestic-demand jump of 4.6 per cent.

Meeting this demand will be expensive, and in future years it could become unprofitable, the association's cost-study committee reported.

Continually rising costs of finding, developing, and producing oil and gas, the committee said, could "make it unprofitable for the industry to drill the required amount of footage." It pointed out that:

. . . The total outlay for finding oil has jumped 35 per cent since 1953. This covers the increased volume of drilling, higher equipment costs, and more employes at higher pay.

. . . Revenue from crude oil has inched up only 10 per cent in the same period.

What's worse, the committee said, is that the industry is selling oil from old fields whose finding and producing costs are far below current costs. The result: Profit statements are deceiving; the industry just isn't making the money its financial reports would indicate.

Continuing increases in the costs of finding, developing, and producing oil "have now reached the point where the maintenance of adequate petroleum supplies from domestic sources is seriously threatened," the committee concluded.

How I.P.A.A. Sees 1957 Supply and Demand

(Thousands of barrels daily, except closing stocks)

	3rd quar. 1956*	4th quar. 1956	Year 1956	1st quar. 1957	2nd quar. 1957	3rd quar. 1957	4th quar. 1957	Year 1957
DEMAND								
Gasoline	4,075	3,877	3,877	3,687	4,286	4,273	4,051	4,076
Kerosine	245	454	345	475	203	230	446	338
Distillate	1,215	2,142	1,796	2,607	1,374	1,285	2,264	1,880
Residual	1,365	1,769	1,631	1,904	1,520	1,416	1,780	1,654
Other products	1,718	1,599	1,584	1,556	1,674	1,835	1,700	1,692
Total	8,618	9,841	9,243	10,229	9,057	9,039	10,241	9,640
EXPORTS (included above)								
Gasoline	100	78	88	81	85	91	86	86
Kerosine	5	9	7	7	8	8	8	8
Distillate	75	62	65	56	64	63	59	60
Residual	85	69	72	64	70	74	67	69
Other products	65	71	72	67	63	70	68	69
Crude	30	28	29	27	28	27	27	28
Total	360	326	333	302	328	333	315	320
DOMESTIC DEMAND	8,258	9,515	8,910	9,927	8,729	8,706	9,926	9,320
TOTAL STOCK CHANGE	+726	—389	+140	—539	+473	+489	—445	—3
TOTAL NEW SUPPLY REQUIRED	9,344	9,452	9,383	9,690	9,530	9,528	9,796	9,637
CLOSING STOCKS (million barrels)								
Gasoline	174.0	183.9	183.9	210.0	182.0	168.0	178.0	178.0
Kerosine	33.8	26.2	26.2	17.0	27.0	34.0	26.0	26.0
Distillate	152.0	118.6	118.6	65.0	100.0	152.0	120.0	120.0
Residual	47.5	43.4	43.4	37.0	43.0	48.0	47.0	47.0
Other products and natural gasoline	116.0	113.4	113.5	118.0	128.0	123.0	113.0	113.0
Crude	278.0	280.0	280.0	270.0	280.0	280.0	280.0	280.0
Total	801.3	765.6	765.6	717.0	760.0	805.0	764.0	764.0
RUNS TO STILLS	8,025	7,922	7,946	8,262	8,044	8,201	8,262	8,191

*Estimated. Based on U. S. Bureau of Mines and A.P.I. figures.

At I.P.A.A. press conference, ODM's Flemming explains . . .

Deadline on Oil Imports

DALLAS.—A definite decision as to whether or not imports of crude oil can be held to desired levels by voluntary action will be made by the Office of Defense Mobilization not later than December 1, Director Arthur S. Flemming told the I.P.A.A.

Flemming announced that he has made it his official conclusion that national security will be threatened if imports are continued into 1957 at the same rate as programmed for the last half of 1956.

Steps to prevent this from happening were outlined by Flemming as follows:

1. By November 8 importers are to file their projected import schedules for the four quarters of 1957. These will be made part of the public record of the recent ODM hearings.

2. Schedules will be analyzed by ODM to see if they meet the February 1955 objectives of maintaining imports at the 1954 ratio to domestic production. ODM's previous exemptions for Canadian and Venezuelan crude, and for all imports to the West Coast, will also be reviewed.

3. The President's Advisory Committee on Energy Supplies and Resources will be asked to suggest specific recommendations for importers for 1957.

4. By November 26 each importer is expected to tell ODM whether or not he will voluntarily comply with the recommendations.

5. By December 1 Flemming will decide whether the revised 1957 programs of importers constitute a threat to security. If so, he will certify that finding to the President. If not, he will continue the policy of voluntary compliance but will maintain close watch on events and effects.

Flemming declined to speculate on what action the President might take if the matter is certified to him. He said the President might ask for additional information on some phase of the problem, but he indicated that data already gathered by ODM should provide sufficient information.

The impression that ODM is aiming at a reduction of only 3,000 bbl. per day in 1957 was denied by Flemming. He said that a cut of 1 per cent under the January-June 1956 level will bring imports of non-Canadian and non-Venezuelan crude to 299,000 bbl. per day in 1957, a reduction of 47,900 bbl. per day under actual imports for the third quarter.

He also expects Venezuelan imports to be held to 420,000 bbl. per day, or 10,000 below the third quarter actual. This will be a total reduction of 57,900 bbl. per day, or 7.3 per cent, in imports east of the Rockies. Except for Canadian imports, he said, this will bring imports east of the Rockies into line with the 1954 ratio.

I.P.A.A. delays action . . . Following Flemming's address, the I.P.A.A. imports-policy committee announced that on December 2 it will meet to decide what to do next.

There were indications that if Flemming's decision is not satisfactory, the I.P.A.A. will ask Congress for specific legislation curbing imports.

Industry BRIEFS

Sinclair Oil Corp. last week completed acquisition of Southern Production Co., Inc. Purchase price was $108,000,000, including nearly $43,000,000 in cash and the rest in payments to be made from production. Sinclair acquired 5,000 bbl. daily of crude production, aside from the production payment, plus oil reserves of 35,000,000 bbl. and gas reserves of 525 billion cubic feet *(The Oil and Gas Journal, October 8, page 56).*

Steps taken to curb air pollution in Los Angeles and Houston will be compared at the national semiannual technical meeting of Air Pollution Control Association to be held in Houston December 3-5. Papers also will describe antipollution programs adopted at individual refineries and chemical plants.

Columbus-Rexall Consolidated Mines Co., Salt Lake City, has purchased properties in four oil fields in California, including 23 producers with a total gross production of 20,000 bbl. per month, and estimated proved reserves of 12,500,000 bbl. The transaction, which was made by cash purchases and stock consolidations, included acquisition of Beachline Production Corp. and Adaven Oil Co.

Wells were purchased in Yorba Linda field, where eight locations are scheduled; Dominguez field, where a 10,000-ft. test is planned; and the Sunset and Huntington Beach fields. Cash consideration for the latter two was in excess of $500,000.

Delta Offshore Drilling Co., Inc., is putting a new self-contained barge to work for The California Co. in Block 69, Main Pass area, on the east side of the Mississippi River Delta. Capable of handling six wells from one location, the barge can drill to 20,000 ft. in 25-ft. of water.

It was built in New Orleans by Avondale Marine Ways, Inc., and is being towed to the drilling area. The barge was christened "Elevated Deck Drill Barge No. 1." It provides quarters for crew of 32, is 156 ft. long, 90 ft. in the beam, and has a hull depth of 11 ft. Height to the bottom of the superstructure is 40 ft.

Zapata Petroleum Corp. of Midland, Tex., has signed an agreement to purchase a one-half working interest in 14 oil wells in the Johnson pool, Ector County, Texas, for approximately $800,000. Production is from the Grayburg-San Andres and includes several semiproved locations.

Offshore Drilling Firm Formed

HOUSTON.—A group of Houston oil operators and marine contractors has formed Mobile Offshore Co. for contract drilling in the Gulf of Mexico.

Contract has been let for construction of the company's first mobile drilling unit, which is scheduled to be completed next June. A spokesman for the firm said the barge is designed to operate in deeper water than any fixed-deck type yet constructed.

The new firm will absorb Thomas & Meadows Drilling Co., offshore contractors. Bowman Thomas, head of this firm, is president and a director of the new company. Other officers of Mobile Offshore are key men in Brown & Root, Inc., Highland Oil Co., and Goldston Oil Corp.

B. THOMAS

The submersible, self-contained drilling unit, designed for water depths of more than 70 ft., will operate on the same principle as a floating dry dock. But to reduce exposure to wave forces, vertical cylinders will be substituted for solid wing walls.

Ingalls Shipbuilding Co., Pascagoula, Miss., has the contract to build the unit. Steel is now being delivered.

The hull will be 201 ft. by 203 ft. Height from the base of the hull to the deck will be 110 ft. The unit was designed by Robert H. Macy, consulting naval architect, Pascagoula.

Officials of the new company said the barge can drill or work over wells at existing production platforms. A cantilever extending from the barge will support the rig over a platform during such operations. The unit will be able to drill as many as eight wells from one location.

As a precaution against accidental flooding of ballast tanks the hull will have no sea cocks, valves, piping, or pump room in the hull. The barge also will have tubes through which four hydraulically operated spud piles will anchor it to the gulf bottom, thus insuring against lateral movement of the unit while drilling.

Company's officers . . . The president of Mobile Offshore Co. formerly was chief petroleum engineer for Humble Oil & Refining Co. and in charge of the marine equipment division and the drilling equipment division. He was in charge of Humble's ship construction when the company started big-scale operations in the gulf and was assistant manager of production before forming his own company in 1955.

Besides Thomas, other officials of the new firm include Herman Brown, president of Brown & Root, Inc., director; Harold Decker, former president of Houston Oil Co. of Texas and now president of Highland Oil Co., director and vice president; and W. J. Goldston, president of Goldston Oil Corp., director and vice president.

Shamrock Posts Cut

Texas buyer reduces crude price to meet competition

AMARILLO.—Shamrock Oil & Gas Corp. will reduce posted prices for the crude it purchases by 7 cents per barrel effective November 5. The company buys in the Texas Panhandle, Oklahoma, and Kansas.

Volume of crude affected totals about 23,000 bbl. daily. That was the amount Shamrock purchased in the late summer, although its daily take has been reduced recently. Shamrock buys chiefly for its 17,500-bbl. refinery at Shamrock, Tex., and also for the account of Humble Oil & Refining Co.

Shamrock President J. H. Dunn explained his company felt that an increase in crude prices actually was justified because of higher costs. But he declared that competitive conditions made a reduction necessary.

Shamrock's new postings will be in line with an intermediate schedule adopted in recent months by other buyers of North Central Texas, West Central Texas, and Texas Panhandle crudes. Top price is $2.83 per barrel for 40°-gravity and above with a 2-cent drop per gravity degree on lower grades.

Dunn pointed out that Shamrock for months had maintained a price for crude it purchased above the price paid by others for a like quality. He added: "We hope the causes underlying this reduced price situation will soon be removed."

Texas Allowable Case Set November 8

AUSTIN.—The Texas Railroad Commission will hold hearings November 8 to decide if it should cut the oil allowable of 11 West Texas and Texas Panhandle fields to relieve nonratable take of oil by purchasers.

An application for such action was filed with the commission by Stanolind Oil & Gas Co. last month. It stems from Phillips Petroleum Co.'s continued cutback on purchases to 75 per cent of the August level. This cutback began October 1.

Phillips says it made the cut because it was and still is unable to market or store all the allowable production of wells to which its pipeline system is connected.

Pools involved . . . The fields concerned at the November 8 hearing include: Panhandle, Spraberry Trend Area and Spraberry Trend Area Clearfork, North Cowden, North Cowden (Deep), South Cowden, Foster, Harper, Johnson, Penwell, Mautex (Devonian), and Ripple-N Ellenburger.

The nonratable take situations in these fields have resulted because there are firms other than Phillips also taking from the pools. The other buyers so far have been able to take full allowable production from wells to which they are connected, while Phillips has not.

The Stanolind request for reduced over-allowable for the fields would bring allowable output of each well down to what Phillips is able to buy from the Stanolind wells.

Approval expected . . . Observers feel that the commission will go along with the request—as it did recently in similar situations during the strike at Cities Service Oil Co.'s big East Chicago, Ind., refinery.

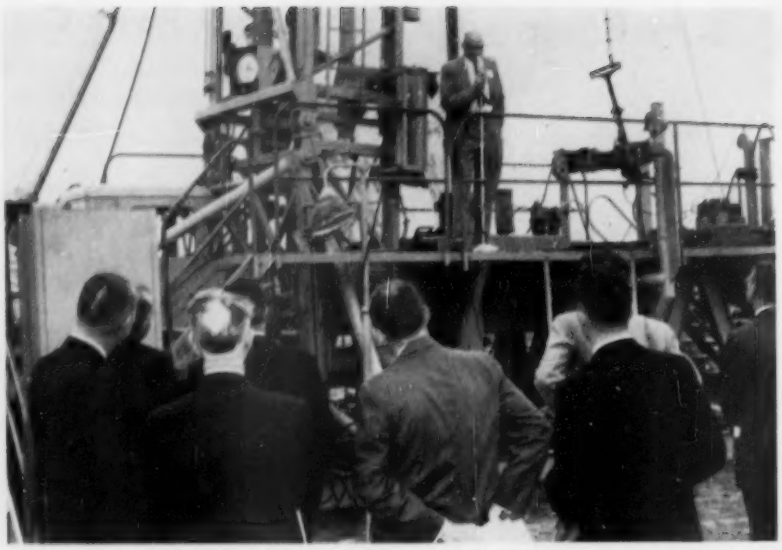
Leased Minerals Clarified

BISMARCK, N. D.—A precedent-setting ruling in U. S. District Court here has clarified the phrase "and other minerals" frequently included in oil and gas leases.

Judge Ronald N. Davies held that oil and gas leases also include uranium rights on lands which later are leased to uranium prospecting firms. He ruled in a quiet title suit filed against Stanolind Oil & Gas Co. and Ohio Oil Co. by the Evangelical Lutheran Church.

In 1953, the two companies took 10-year leases on about 2,000 acres of church-owned land in southwestern North Dakota's Billings County. In 1955, the church granted a lease to a uranium prospecting concern on the same acreage. The church contended the earlier leases applied only to oil and gas and related fluid hydrocarbons.

Judge Davies ordered title to the land quieted in favor of the church, but subject to leaseholds of the two oil companies.



EXPLAINING OPERATIONS from the platform during turbodrill demonstrations is George Pfefferle, Dresser director of engineering.

DRILL'S INTERNALS—rotors, stators, thrust bearings, and other parts—are inspected by visitors.

Turbodrill Gets Premiere

Russian tool achieves 10-ft. per minute penetration rate in Dallas tests, guests attending first U. S. showing told

DALLAS.—Hole-making prowess of the modern Russian turbodrill was demonstrated here last week in the drill's premiere U. S. performance.

The show was staged by Dresser Industries, Inc. Attending was a diverse group of government officials, members of the trade press, and oil men here for the annual meeting of the Independent Petroleum Association of America.

Site of the demonstration was the mid-Dallas plant of Guiberson Corp. This newly acquired Dresser subsidiary is expected to begin tooling up next year to manufacture the turbodrill.

500 ft. per hour . . . Dresser has been testing a 10-in. turbodrill intermittently for nearly 2 weeks using a conventional 12¼-in. rock bit.

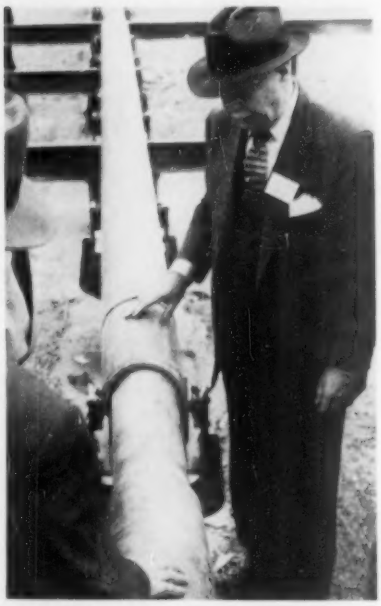
In slightly less than 2 hours of actual drilling time, the turbodrill has reached a depth of 1,085 ft. Penetration rates in the relatively soft digging were as high as 10 ft. per minute.

During the public demonstration, the turbodrill was making hole in shaly limestone zone. It was jokingly termed the "main street lime" by Dresser's Director of Engineering, George Pfefferle.

Mud was circulated at a rate of 630 gal. per minute, compared with a capacity of about 1,000 gal. per minute. Weight on the bit, due to the easy digging, was considerably less than the 40,000 lb. normally carried. Bit speed ranged between 600 and 700 r.p.m. Pressure drop across the turbine was between 600 and 700 psi.

Best in rock . . . Pfefferle pointed out that the Russian turbodrill achieves its best comparison with conventional rotary equipment in drilling hard formations.

J. B. O'Connor, president of Dresser



DRESSER PRESIDENT J. B. O'Connor watches as drill's inner mechanism is pulled from casing.

GREAT THINGS are expected of the turbodrill by Dresser, and Pfefferle uses charts to show visiting oil men why.

and one of the few westerners to view the turbodrill operating in Russian fields, underlined this point. He said the Russians are now rapidly drilling extremely hard formations with the turbodrill and developing pay zones they formerly were unable to reach with conventional equipment. He cited as examples fields in Romania and the Hurh Ufa field in eastern Russia.

Such hard zones aren't available at the present test site. Dresser is expected soon to start testing the turbodrill in known hard-rock areas in the United States, probably West Texas.

The guests also were shown the bulk of the 40 turbodrills Dresser recently imported. They included various sizes of the regular, core and sectional drills.

Pfefferle said good cores had been recovered with the core-type turbodrill. The sectional version actually is several turbines coupled together to increase torque for use primarily in softer formations.

Tidelands Claimed

Firm argues 1942 contract gave it Long Beach rights

LOS ANGELES.—Right to develop the tremendous oil reserves which underlie submerged lands offshore from the city of Long Beach was claimed by Dynamic Industries Co. in a Superior Court complaint here last week.

The company, headed by H. A. Hansen, claimed that it was awarded a development contract by the City Council in March 1942. Though never signed by the council, the proposed producing and operating contract was accepted and approved "paragraph by paragraph" at that time, the complaint stated.

State and federal litigation has since prevented completion of the contract, but it is still binding, Dynamic Industries claimed. The city countered with the claim there is no contract because the final agreement was never signed by the city manager.

Contract terms . . . The 1942 contract, as approved by the City Council, pertained to city submerged lands extending from the Los Angeles flood control channel to the eastern city limit some 6 miles distant. The city was to receive 16⅔ per cent royalty from Ranger zone wells and 20 per cent from any deeper pays.

Development was to have been carried out in subterranean caissons connected by tunnels to a land-based entry shaft. It was planned to drill 20 directional wells from each site. This method of development would not interfere with navigation in the harbor area.

watching WASHINGTON

. . . with Bertram F. Linz

Refuge freeze thawing out . . .

A NUMBER of applications for leases on government wildlife refuges, frozen for several months, are expected to be turned loose after the election, regardless of which party wins.

A resumption of leasing late last year, after a freeze of nearly 2 years, brought conservationists raging to Washington. They secured a congressional investigation at which Interior officials detailed the stiff requirements they impose to protect wildlife and, in fact, improve the refuges.

The committee took no formal action. But it secured an agreement from former Secretary Douglas McKay to keep the committee advised of prospective leases. A large number of applications are pending in the department. But Secretary Fred A. Seaton has strongly defended the plan to develop oil-bearing refuges and is expected to test congressional sentiment again by granting some leases.

Amortization—a fish out of water? . . .

A PROBE of the tax amortization program will be one of the first items on the 1957 congressional program.

Sen. Harry F. Byrd of Virginia, head of the joint committee on internal revenue taxation, started the ball rolling last month. He ordered his staff to make a study of all industry expansion programs. And he asked Mobilization Director Flemming to hold up new programs until the inquiry is completed.

The oil industry has spent several billion dollars on new plants under the incentive of quick tax write-offs, much of it since the end of the Korean war. But Byrd questions whether the Government should continue wartime incentives in peacetime.

Certificates issued during the first quarter this year covered the highest investment recorded for any like period since the middle of 1952. And the Office of Defense has set new expansion goals which could push the figure even higher if amortization is continued.

The oil industry is still waiting for word on whether amortization will be granted for a long list of projects, cost of which would exceed $4,000,000,000. Most of this would go for expansion of refining and pipelines. Just how many of the projects would be carried out if quick write-offs were shelved is not known. But without this help, additional cost to the industry would be great.

If imports pose a threat . . .

OIL importers' schedules for 1957 are due to be filed with Defense Mobilizer Arthur S. Flemming this week. And domestic producers and importers alike are wondering what comes next if the schedules show that imports will be a threat to national security and Flemming so reports to the President.

Under the trade agreements act the President, on receipt of such a report, must have an investigation made if he agrees with Flemming.

The big question: How long would it take to get the adjustment of imports called for in the law?

Flemming already has made an investigation. The President could act on Flemming's findings. That could be done quickly. But the President also could set up a new group to make the inquiry. That could be strung out over considerable time.

Eisenhower is strongly opposed to quotas. Control by tariffs is out, barring an act of Congress. But nobody appears to have come up with any ideas for an alternative.

More time will be required to decide exactly how to handle the problem if the President finds controls are necessary. Meanwhile, Congress will be back on the job in just 2 months. It may deal itself in if the administration drags its heels. And the idea pressed in Congress last year was quotas.

Rangely Unit Near?

Operators in Colorado's largest field study new plan; hopes high for agreement after 10 years of negotiating

DENVER.—Rangely field, Colorado's largest, might be nearing unitization.

Operators have been negotiating such a move for 10 years, but without success. Now, at their request, the Colorado Oil and Gas Commission has postponed a hearing scheduled for November 8 so they can study a unitization proposal submitted by The California Co.

The commission hearing, set up to review the effects of a conservation order issued in July, has been moved back to November 28. Presumably, it will be canceled altogether if plans for unitization are worked out.

Operators taking a close and hopeful look at Calco's plan include Sharples Oil Corp., Stanolind Oil & Gas Corp., Phillips Petroleum Co., and The Texas Co.

Just how close they are to a meeting of the minds remains to be seen. They might be a long way. But operators, though still cautious, are approaching the problem with an optimism that was missing until recently. As one put it:

"There's still a lot of ground to cover, but we made a lot of progress at a meeting last July. The general attitude is much better and there now seems to be a good spirit of cooperation. I think we are getting closer."

This is in sharp contrast to the feeling which persisted during earlier negotiations, when tempers sometimes flared and chances for agreement seemed remote.

Principal stumbling block in the way of unitization has been a participation formula which would be acceptable to all operators.

The field's operators have not been able to agree on the value of certain leases. The differing opinions center around the question of just how much oil the sand in various parts of the field will give up.

Water flood . . . Rangely might also be in line for a water flood project before too many months pass. Phillips is conducting preliminary surveys.

The company denied reports that it is "spearheading a drive" for a Rangely flood, although admitting that laboratory tests are being carried out in this respect. But it's all just routine, Phillips stressed.

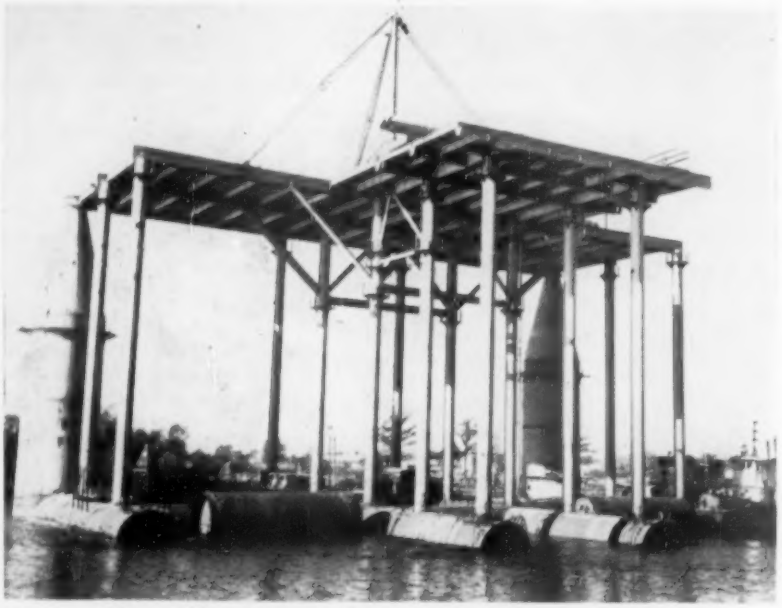
Last July, the Colorado Oil and Gas Commission limited production to 300 bbl. daily for any well and required that accompanying gas in excess of 180,000 cu. ft. be reinjected.

Production and reserves . . . This has caused many operators to reduce production because they can't put enough gas back into the formation. Most of the majors, however, indicate they plan to remedy the situation.

The California Co., largest operator in the field, is installing two additional compressors, bringing to 18 the number engaged in gas reinjection. Stanolind Oil & Gas Co. has three in operation and has ordered two more. The Texas Co. has several at work.

Rangely production dropped from 81,477 bbl. daily in May to 75,450 bbl. daily in September. In August, the first full month under the commission order, production was off about 5,500 bbl. daily from May.

Total production in 1955 amounted to 23,678,000 bbl., bringing accumulated production at the end of last year to 189,350,000 bbl. Remaining reserves are estimated at 176,650,000 bbl.



THIS IS ONE OF TWO huge structures that will make up Kermac's new rig.

Kermac Plans New Spectacular

ORANGE, Tex.—Two giant steel structures weighing nearly 8,000,000 lb. have been floated downstream 50 miles to the Gulf of Mexico where they will be assembled into another drilling barge for Kerr-McGee Oil Industries, Inc.

The new vessel, Kermac 47, is expected to be assembled in about 2 weeks. It will be a duplicate of the company's Rig 46, recently commissioned at Pascagoula, Miss. *(The Oil and Gas Journal, October 29, page 64).*

Built by American Bridge Division of United States Steel Corp., the two units will be assembled into a single structure 202 ft. wide, 242 ft. long, and 100 ft. high. Coast Guard boats controlled traffic on the Sabine and Neches rivers during the 22-hour trip downstream from Orange to the assembly point at Sabine Pass.

Decision to assemble the barge in the edge of the gulf was prompted by the unit's tremendous size. Floated down the Sabine River in one section, the barge would have had only about 18-in. clearance on each side at the Port Arthur bridge.

A shipyard spokesman said fabrication at Sabine Pass will be more difficult than at the yard, however, because of shifting tides and gulf winds.

Once assembled, the unit will be too large to travel the Intra-Coastal Canal. Plans call for towing it across the open gulf and around the mouth of the Mississippi for outfitting at Pascagoula.

Octanes Still Climb

Monthly Ethyl survey for October tests 442 samples

NEW YORK.—Octane ratings on regular and premium grades edged up slightly in October, according to Ethyl Corp.'s latest monthly survey.

For premium, the weighted national average of 53 cities stood one-tenth of a number above September and 1.1 numbers above October 1955.

As in recent months, nearly 90 per cent of the cities sampled showed averages of 96 octane or better.

The third-grade superpremium which is offered by a few companies is not surveyed. But some beefed-up premiums showed up in coastal cities.

Coastal octanes peppy . . . Last month, samples of one company's product taken in nine cities showed 99 research octane or higher. Sixty-one samples of various brands in 23 cities rated in the 98 to 99-octane bracket.

These samples were mainly from along the East and Gulf coasts, although eight marketing areas in the Middle West and South also showed some 98-octane product.

The survey covered 442 premium samples.

PREMIUM

(Cities per octane group)

	Oct. 1956	Sept. 1956	Oct. 1955
90-90.9	0	0	0
91-91.9	0	0	1
92-92.9	0	0	1
93-93.9	2	2	3
94-94.9	2	3	9
95-95.9	3	3	18
96-96.9	18	19	16
97-97.9	26	25	5
98-98.9	2	1	0
Total cities	53	53	53
Wtd. avg. R.O.N.	97.1	97.0	96.0
Wtd. avg. TEL, ml. per gal.	2.59	2.59	2.59

REGULAR

(Cities per octane group)

	Oct. 1956	Sept. 1956	Oct. 1955
81-81.9	0	0	0
82-82.9	0	1	1
83-83.9	1	0	1
84-84.9	0	0	1
85-85.9	1	1	5
86-86.9	4	5	12
87-87.9	10	7	6
88-88.9	6	8	8
89-89.9	13	13	9
90-90.9	0	2	8
91-91.9	14	9	2
92-92.9	4	7	0
Total cities	53	53	53
Wtd. avg. R.O.N.	90.2	90.1	88.8
Wtd. avg. TEL, ml. per gal.	2.31	2.31	2.30

Refining BRIEFS

Cities Service Co. has entered the third-grade competition with a 100-octane gasoline in nine eastern cities. The company took the wraps off its "100 Plus" pumps in New York, Boston, Providence, Newark, Philadelphia, Baltimore, Washington, Richmond, and Norfolk. It will continue to market its premium-grade "Super 5-D" and its regular-grade "Cities Service Milemaster."

Union Oil Co. will begin construction soon on an ethylene plant at its Los Angeles refinery. The new facility, scheduled for completion early in 1958, will use refinery gas to produce a maximum of one million pounds of ethylene annually. Most of the ethylene will be moved by pipeline to the Brea Chemicals-Koppers Co. polyethylene plant now being built nearby. The balance will be sold to other chemical manufacturers.

The Brea-Koppers plant will process the ethylene into low-pressure polyethylene under the Ziegler process. This plant will have ultimate capacity of 60,000,000 lb. annually and will go on stream in mid-1957.

Fluor Corp. of Canada has been awarded contract for engineering and construction of offsite facilities required for a new reformer and crude units being built by British American Oil Co. at its Clarkson, Ont., refinery. The $4-million project is scheduled to be completed next year.

Foster Wheeler Corp. has the construction contract for building an Ultraforming unit at Neodesha, Kans., refinery of Standard Oil Co. (Ind.) which will put the plant in the high-octane race. The unit is scheduled for operation early in 1958. It will charge 6,000 bbl. daily of naphtha and will include a catalytic desulfurization unit for feed preparation.

National Petro-Chemicals Corp. plans to double its production capacity for polyethylene at Tuscola, Ill., at a cost of $10 million. The plant started operation in 1955 with designed capacity of 26 million pounds a year. It currently is operating at twice that capacity and expansion will push output to 100 million pounds a year. National Petro-Chemicals is owned by National Distillers Products Corp. and Panhandle Eastern Pipeline Corp.

The Texas Co. has awarded an engineering and construction contract to the Fluor Corp., Ltd., for an 80,000-bbl. daily vacuum pipe still at the Port Arthur, Tex., refinery. Construction will start next February with completion scheduled for December 1957. The new vacuum pipe still will replace existing units having a 60,000 bbl. daily charge capacity.

Tentative agreement on a 1-year labor contract has eased the threat of a strike at Pure Oil Co.'s refinery near here. A strike was authorized recently by members of Local 4-228, Oil, Chemical and Atomic Workers Union *(The Oil and Gas Journal, October 15, page 94)*. Details of the agreement were not disclosed.

Laurentide Chemical & Sulphur Co. has started construction on a $1.25-million plant at Montreal East to manufacture elemental sulfur from petroleum gases. It is the first such facility in eastern Canada. The sulfur will be sold largely to pulp and paper mills in the Montreal area and will replace imports brought from the U. S. Gulf Coast area.

Also for Refiners . . .

No additions to products stocks will be needed during the next year, according to the I.P.A.A. supply and demand committee (P. 63) . . . Ethyl's October survey shows weighted averages of premium and regular continue upward (P. 69) . . . Atomic radiation as a useful tool in refineries and petrochemical plants is nearer than many think (P.70) . . . Iraqi Government will ask bids next month on a plant to strip sulfur from Kirkuk natural gas . . . European firms present more liberal financing terms as Argentina seeks money for oil projects (P. 83).

PLUS THESE TECHNICAL FEATURES: W. L. Nelson's refinery construction index (P. 90) . . . Single-case reforming teams up with Unifining (P. 111) . . . Multicolumn flow-process chart saves steps in processing jobs (P. 120) . . . How tower pressure can be controlled (P. 123) . . . The iron sponge (dry box) method of desulfurizing natural gas (P. 125) . . . What steps to take for computing piping costs more accurately (P. 127) . . . and specifications for painting tanks (P. 129).

Atomic Processing Growing Up Fast

- **Reactors now being built for generating power may give petroleum, chemical processors quick source of radiation**
- **Oil companies advised by scientific symposium to start basic research now to give personnel valuable know-how**

BOSTON.—Oil refiners and petrochemical manufacturers will hear much about "radioprocessing" in the next few years. Commercial application of atomic radiation is nearer than most people think.

These views were spotlighted for refinery personnel attending a 3-day symposium on applications of radioactivity in petroleum research and refinery operations. The meeting was sponsored by Tracerlab, Inc.,

Atomic reactors for commercial use at the present state of development are being designed for power alone. Engineers are so beset with problems in this respect they have not yet seriously considered further use of radiation which occurs automatically in any pile. Radiation, in fact, is looked upon as a nuisance to be contended with until all the answers are found to reactor operation for power itself.

Reactor tie-ins . . . This situation will not prevail indefinitely, said Professor Clarke Goodman of Massachusetts Institute of Technology.

He foresees the day when atomic reactors will cease to be single-purpose projects, producing power or plutonium. Multipurpose projects making full commercial use of the radiation occurring in the pile itself are coming.

Goodman is now on leave from M.I.T. as assistant director of reactor development for the Atomic Energy Commission and speaks with some authority. He pointed to the budding reactor program which represents a vast potential in radiation energy. How this radiation will be used is anyone's guess at present. But it is quite likely that the oil industry, now leading all others in isotope usage, will be heavily involved.

Regardless of the time schedule on radiation processing, Goodman feels strongly that now is the time to begin research. Any oil company which expects 10 years or more hence to compete in utilizing this tremendous new energy source must be carrying out its basic investigations now. Radiation will be made available to refiners.

On its way . . . First commercial application of radiation on a large scale may appear first in petrochemicals.

Joseph J. Martin of the department of chemical and metallurgical engineering at the University of Michigan said his candidate for the honor was radiopolymerization of ethylene. The result is a high-grade polyethylene produced at room temperature and low pressure.

Work at Michigan's Engineering Research Institute bore out previous findings that ethylene will polymerize when exposed to atomic radiation. Researchers found that a small amount of gamma radiation resulted in a relatively high yield of the polymer. This followed the anticipated use of radiation to trigger a reaction which then proceeds largely under its on steam.

The concept of radiopolymerization is not new. But Martin's translation of this laboratory work to a commercial plant design is news. In scaling up from laboratory to plant production of 60,000,000 lb. per year, he obviously estimated the cost of radiation from spent fuel elements, waste fission products, or radioactive isotopes.

But the cost breakdown which he had the courage to reveal to the symposium meeting indicated this commercial application may well be in the ball park. On both investment costs and operating costs, Martin's figures showed that the radiation route is competitive with both high and low-pressure processes in use today. While some engineers present could challenge some of his assumptions, the importance of this full-scale commercial concept was not to be denied.

Isotopes: How to start . . . While the meeting had its spectacular moments, much of the discussions revolved around the profitable, day-to-day use of isotopes in refineries and laboratories.

Refiners looking at this field for the first time were handed some sound advice and given startingly low cost figures on isotope facilities.

They were told:

. . . Cost of facilities and isotopes can be much lower than generally expected.

. . . Safeguards take top priority. It has been shown that when properly handled isotopes pose no danger to personnel.

. . . Education of employes, their families, and local authorities pays off handsomely.

. . . Savings of $200 million were realized by industry this year through isotope applications.

. . . Oil industry leads all others in isotope application.

. . . Insurance rates for radiation need not be burdensome.

Costs can be kept low . . . Frank H. Low of Tracerlab gave some interesting cost estimates on conventional isotope facilities.

For wear tests of irradiated piston rings—a routine set-up in many laboratories—necessary equipment includes a scintillation detector, irradiated piston ring, and the necessary protective equipment for personnel. For noncontinuous work of this type, using only a scaler, the total bill comes to about $2,000. If a completely automatic set-up is desired, $6,000 should cover it.

For catalyst density tests in commercial units, the job can be done with a shielded source with variable openings, an industrial type scintillation counter, a rate meter, and a standard strip chart recorder. These, plus the necessary personnel protection equipment, can be had for $3,000.

Frankness an asset . . . The best approach to an isotope project, is the open one.

Any company launching an experimental or testing program using radioactive materials should first avail itself of the orientation and training available from the AEC and from isotope service companies.

Once licensed to go ahead, a full, frank disclosure of all pertinent information on the project is next in order. This paves the way for understanding and cooperation on the part of labor, Government, and neighbors, said Robert Gallagher of Liberty Mutual Insurance Co. The responsibility for safety must rest with one full-time supervisor who is thoroughly trained in his job.

Records are of prime importance, said Gallagher. All data on exposure of personnel should be filed and kept indefinitely for employer protection. Proper selection of personnel working with isotopes is also important. Considerations are his state of health, prior X-ray treatment, etc. The company which invests time and money in a thoroughly safeguarded isotope program will save money in its insurance policy, Gallagher said.

More isotopes, lower cost . . . The isotopes program has barely begun, said Paul C. Aebersold, director of the AEC's Isotopes Extension, Division of Civilian Application.

The first isotope shipment went out of Oak Ridge in August 1946. Since then, industry has steadily increased its usage. In 1950, about 100 firms received shipments from AEC. This year more than 1,400 will be using isotopes.

Most isotopes are now available in almost unlimited quantities, said Aebersold. The supply will continue to be dependable. Their cost in general does not hinder usage, and as demand grows, prices will go down. The rapid development of better instruments has greatly improved isotope techniques. These instruments, together with many tailor-made radioactive compounds, are now available from several service companies who also consult and conduct training.

The AEC still administers a federal control program of licensing and inspection of isotope facilities. Possession and use of radioactive material requires federal permission. To these ground rules, industry should add its own standards. It is up to private enterprise representing both the end users and the processors and distributors of isotopes to promote the training of scientists and engineers so that the program may expand.

New analysis tool . . . Another AEC representative told refiners and researchers how they could use activation analysis.

Minute quantities of trace elements can be detected and measured in petroleum fractions and catalysts, according to George W. Leddicotte of the activation analysis group at Oak Ridge National Laboratory.

Petroleum laboratories can send petroleum or catalyst samples to Oak Ridge, where qualitative and quantitative analyses have been made for 32 different elements. Concentrations of 0.001 parts per million can be detected for gold. Less than 1 p.p.m. of arsenic, antimony, phosphorus, chlorine, bromine, vanadium, and copper can be measured by this technique. Nickel, iron, and mercury can be detected and measured down to 1 p.p.m.

What's the future? . . . The variety of uses for isotopes is being accelerated and new refining companies joining the list of users are increasing.

The symposium was told that a number of refinery applications of isotopes have become routine. These included studies of entrainment and leakage, and catalyst work involving aging, density, flow rates and flow paths. Liquid flow in distillation columns, basic studies on turbulent fluid flow and wear rates of engine parts also came up for detailed attention.

ATOMIC ENGINEERS from petroleum and allied industries in 23 states, Canada, and France attended the Boston symposium on applications of radioactivity. Among them are, left to right: Harold M. Smith, U. S. Bureau of Mines, Bartlesville, Okla.; Harold Hammen, American Oil Co., Texas City; R. O. Campbell, British American Oil Co., Ltd., Toronto; Alex G. Oblad, Houdry Process Corp., Philadelphia; J. A. Parker, Shell Chemical Corp, New York; Jerome Kohl, Tracerlab, Inc., Richmond, Calif.; and J. T. Harlan, Shell Chemical, New York.

In the latter category simultaneous measurement of the sides and face of piston rings was discussed by R. G. Abowed and C. E. Alsterberg of Ethyl Corp. This technique employed chromium and iron surfaces of the ring, irradiated and determined separately as wear progressed in an engine.

Extraction techniques now in development will vastly increase the supply of many radioactive isotopes from fission products from government reactors. Soon another vast potential source of isotopes will be available from the nation's program now gathering steam. Private enterprise together with state and local governments and the AEC now have 17 nuclear power plants planned, under development or under construction. All told, they will have over 1,300,000 kw. in electrical capacity.

While these plants are still single-purpose in design, it is possible that some of their byproduct radiation may find commercial use. Some could be made available through interim use of spent fuel elements which must be stored underground until they decay to a point where they can be safely handled.

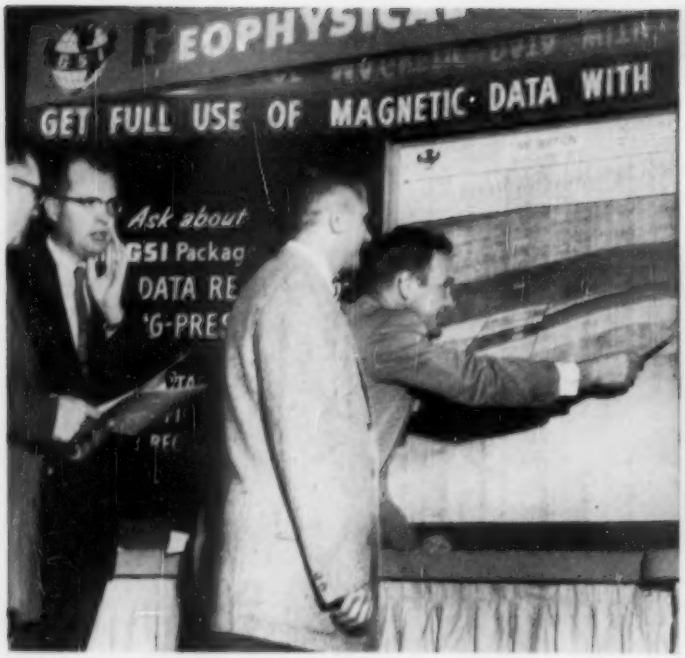
But the important amounts of radiation generated in these power reactors are available inside the pile itself. Most of this is wasted in the shielding, but it was estimated that perhaps 5 per cent of this radiation might be put to useful purpose in the form of gamma radiation. Exposure could take place either in the pile itself or adjacent to it by means of circulating streams of gamma-emitting materials.

The size of the building program at this early stage indicates that even 5 per cent of the radiation produced as a byproduct of power would probably meet commercial requirements at many plants.

This power program tends to raise the sights of the oil industry regarding future possibilities of radiation processing. The economics or the exact techniques of processing have not become clear. But the vast radiation energy potential from plants already on the way refutes the original contention that processing requirements will be greater than the supply of radiation.

All that remains is the engineering know-how to expand these single-purpose reactions to dual purpose for power and radiation use. This is an enormous task but not considered impossible by experts attending the symposium.

About 100 engineers and scientists from petroleum refineries and research laboratories attended the sessions. Tracerlab plans to follow up the Boston sessions with another symposium next October on application of radioactivity to exploration, drilling, and production. It will be held either in Houston or Richmond, Calif.



HOW TO MAKE geological interpretations on a seismic record is being explained to D. R. Lucas, California Co. geophysicist, by J. M. Proffitt, right, of Geophysical Service, Inc. At left are T. E. Dennis and Robert Graebner, of G.S.I.

THE CAMERA that turns out a variable-density record is examined by S. W. Schoellhorn and R. W. Mossman, Seismograph Service Co., Tulsa.

New Machines Will Help Oil Explorers

NEW ORLEANS. — Geophysicists now can present their data in a form that management and geologists can readily understand.

Seismic data is fed into a machine that automatically plots the information on record sections. The final result:

. . . **Preserves** original seismic data in cross-section form.

. . . **Removes** near-surface distortions.

. . . **Correlates** geological and geophysical data.

. . . **Presents** seismic data in a usable and easily understood manner.

Record sections are cross-sections based on geophysical data. The sections can be plotted either in time or depth. Geologists prefer the latter since they think in terms of depth, and this is particularly true when setting up a wildcat objective.

Individual reflections are easily traced across record sections. Unconformities are readily apparent. Faults show up as breaks in the continuity of the reflections.

In the past this information was plotted on seismic sections by hand. Only data that were considered valid appeared on these laboriously hand-plotted sections. Record sections, however, are based on the automatic plotting of all the data on the original seismic record.

New equipment . . . Several devices for performing this function were displayed for the first time at the Society of Exploration Geophysicists meeting here last week.

Geophysical Service, Inc., of Dallas presents a record section that closely resembles a set of seismograms laid side by side. The original magnetic records are run through a newly designed "time-depth conversion camera" invented by E. G. Perry of Texas Instruments.

The camera converts the magnetic records to either a time or depth record. A group of these records is combined to form a record section. Since the seismic velocity usually varies with depth or with time from setting off the dynamite charge, the camera has a simple but highly accurate arrangement for handling the velocity variation.

United Geophysical Corp. has available a machine that presents a different looking section, based upon a "variable intensity recorder." This process, "Strataprint," was originally developed by Gulf Research & Development Co. and United has the license to manufacture the machine.

Variable-intensity films are made in the field along with conventional seismic records. The films are corrected for weathering and normal moveout. Several are pasted together to form the master cross-section. Reproductions are then made from the master print. These "Strataprints" are easily analyzed and can be used to show structural interpretations, stratigraphic plays, and the like.

Seismograph Service Corp. of Tulsa uses a variable density cross-section. Here again the normal corrections are made to the field data and the finished product is a seismic record section that can be rapidly analyzed.

Geologists welcome the variable-intensity and variable-density sections because the over-all impression is a layered effect. This resembles the subsurface strata and is easily understood. With this type of section, the analysis can be made directly on the print. Or, the interpreter may use a transparent overlay to plot his interpretation.

Geophysicists may prefer the integrated seismic sections that Geophysical Service, Inc., presents, or the type that Reynolds Southwestern Corp. utilizes, because they resemble a collection of seismic records. Each reproduces all the seismic data that would be recorded on a conventional record.

Line Awards Made

● Zachry receives three spreads on Texas Eastern line to tap Mexican gas

SHREVEPORT.—Contracts have been awarded for the 422-mile, 30-in. line through which Mexican gas will be imported to Texas Eastern Transmission Corp. customers in northeastern U. S.

Awards were made last week for six spreads of 30-in., a 24-in. lateral, and five river crossings on the line extending from McAllen, Tex., to the Vidor compressor station near Beaumont. Bay crossings will be let later.

Construction is already under way and completion is set for the fall of 1957.

Contract winners . . . Three of the 30-in. spreads went to H. B. Zachry Co., San Antonio; two to Houston Contracting Co., Houston; and one to H. C. Price Co., Bartlesville.

They were broken down as follows:

. . . Zachry, Spread 1, starting at the Rio Grande River near McAllen and extending 67 miles northeast.

. . . Zachry, Spread 2, another 67 miles from the end of Spread 1.

. . . H. C. Price, Spread 3, 70 miles.

. . . Zachry, Spread 4, 67 miles.

. . . Houston, Spread 5, 61 miles

. . . Houston, Spread 6, 59 miles ending at the Vidor station where the line will join Texas Eastern's existing system extending from the Gulf Coast to the Philadelphia - Newark consuming area.

Lateral and river crossings . . . Grayco Constructors, Inc., Austin, received the contract for 45 miles of 24-in. from Blessing to Provident City, Tex. It links the McAllen-Beaumont line to Texas Eastern's main line tapping the Wilcox trend gas supply near Provident City.

Pentzien, Inc., Omaha, will build the five 30-in. river crossings. They will span the Trinity, Brazos, Colorado, San Bernard, and Cedar Bayou.

Texas Eastern expansion . . . The project is part of an $82,700,000 expansion program which also includes 77 miles of 30-in. looping and addition of 32,250 hp. in compression to increase deliveries 250,000,000 cu. ft. per day.

At first 115,000,000 cu. ft. daily will be supplied by Petroleos Mexicanos (Pemex) from its 300,000,000-cu. ft. Reynosa plant near the U. S. border. Deliveries will build to 200,000,000 cu. ft. when Mexican reserves warrant *(The Oil and Gas Journal, October 15, page 92).*

Pipeline BRIEFS

The 190-mile, 20-in. crude line from Griffith, Ind., to Cygnet, Ohio, once reported dormant, will be built next year. Design and right-of-way procurement are under way. Construction start will depend on when pipe is delivered.

The project will be built by Tecumseh Pipe Line Co., a joint venture of Sinclair Pipe Line, Ashland Oil & Refining, and Pure Oil. It will be completed late next year.

Western Construction Co., Austin, Tex., has completed 25 miles of 30-in. from Forest Hill, Md., to Quarryville, Pa., for Transcontinental Gas Pipe Line Corp. Western also has the contract for a 30-in. Susquehanna River crossing near Delta, Pa. The jobs are part of Transco's extensive looping of its transmission system from Louisiana to Pennsylvania.

Interstate Oil Pipeline Co. has received permission from the Wyoming Public Service Commission to abandon its crude-oil pipeline from Wyoming's Frannie oil field to Silvertip, Mont.

The 400 bbl. handled daily by the 6-in. line for Farmers Union Central Exchange, Billings, Mont., will be transported through Ohio Oil Co.'s line between the Frannie field and Billings. Commission approval was necessary because a 1.5-mile section of the line is located in Wyoming's Park County.

Northern Natural Gas Co. plans to start immediate construction of a gathering system to connect additional reserves in Edwards County, Kansas, to its main line a few miles to the west. The gas was purchased from Skelly Oil Co., Tulsa. It is located 8 miles southeast of the Belpre gas pool in the eastern part of Edwards County.

Western Pipe Line, Inc., is laying 295 miles of big-inch line for El Paso Natural Gas Co.'s expansion to deliver an additional 150,000,000 cu. ft. of gas daily to California. Western is scheduled to complete a 149.3-mile, 20-in. section from San Juan to Maricopa by December 1.

Western also has the contract for 145.7 miles of the 338.8-mile, 34-in. line from El Paso's Blanco, N. M., plant to Topock, Ariz. This section is to be completed February 1. McVean & Barlow, Inc., expects to complete 28.1 miles of 10-in. from the Westlake plant to the Jameson booster in Texas by the first of the year.

Houston Contracting Co., Houston, Tex., has received the contract for 120 miles of 20-in. for Texas Gas Transmission Corp. from Eunice, La., east to Thibodaux, La.

Pipe laying was started on two spreads late last month. They were a 50-mile section from Eunice to New Iberia, and a 45-mile section from New Iberia to Morgan City, La. Pipe laying is scheduled to begin next week on a 25-mile spread from Morgan City to Thibodaux. Houston plans to complete 30 miles of 8 and 12-in. laterals for Tennessee Gas Transmission Co. this week near Golden Meadow and Leeville, La.

A Pipeline Division has been formed by the American Society of Civil Engineers in recognition of the wide activity of many of its members in the pipeline field. It supplants the pipeline committee of the Construction Division. Eldon V. Hunt, Calgary, chief engineer for Alberta Gas Trunk Line Co., is chairman.

Some 159,000 bbl. daily of crude oil was delivered last month to refineries and tankers through the Trans Mountain pipeline system from Alberta. Scheduled deliveries for November amount to 140,000 bbl. daily "or higher," the company reports. Capacity will be increased this month when the new pumping station at Laurel, Wash., is completed.

Also for Pipeliners . . .

Construction has started on Texas Eastern's line which will move Mexican gas into the United States (P. 73) . . . Canadian board turns down Westspur's proposal for Saskatchewan crude line . . . Pacific Northwest gets approval to sell additional gas to Westcoast Transmission (P. 74) . . . Panhandle asks Supreme Court to reconsider fair field price decision (P. 78).

PLUS THESE TECHNICAL FEATURES: How Gulf Interstate Gas succeeded with its remote-controlled station (P. 137) . . . Five men operate a 15,000-hp. centrifugal-compressor station (P. 137).

Sharks Cleansed of Libel Taint

LOS ANGELES.—Opponents of California's controversial oil and gas conservation measure found themselves in deep water with sharks last week.

The bitter issue which has split the California oil industry in recent months will be settled at the polls in Tuesday's balloting *(The Oil and Gas Journal, October 1, page 60)*.

But as an eleventh-hour move to cap their vote drive, opponents of Proposition 4 on the ballot called on a friend used so successfully in 1931 to defeat the Sharkey oil bill. Thousands of sharks were plastered on billboards throughout the state. They joined such other forms of animal life as hogs and rhinoceroses on the boards.

When first posted the bill contained a message of "stop the oil sharks. No on No. 4." It showed a big fish labeled "monopoly" just about to swallow a little fish labeled "you." Suddenly one morning the words on the fish were blanked out with sheets of white paper (see photo).

Opponents immediately yelled "censorship" and claimed the billboard companies had blocked out the offending words at the request of Standard Oil Co. of California, one of the bill's proponents.

California Standard declared the campaign of forces opposing Proposition 4 "represents a shortsightedness and evidences a lack of taste seldom if ever heretofore matched." The company added that "references to monopolies tend to injure the reputation and business of the whole petroleum industry."

The billboard companies said their attorneys advised against using the posters containing the word "monopolists." The lawyers held that charging anyone with being monopolists, which is illegal, could constitute grounds for libel suits.

Meanwhile, voters are being wooed up to the last minute by both sides in the most expensive political campaign California has ever witnessed. Both sides have employed every possible medium of communication—direct mail, billboards, spot radio and TV announcements, newspaper advertisements, and extensive use of speakers bureaus.

Despite this barrage of information, the average voter still is not too well informed on the issue. The technical nature of the proposal defies a simple explanation.

Westspur Line Turned Down

OTTAWA. — Westspur Pipe Line Co., Edmonton, has lost its bid to build a crude pipeline system in southeastern Saskatchewan.

The Canadian Board of Transport Commissioners rejected its application. A similar line serving the same area of Halbrite and Weyburn fields is already being built by Trans Prairie Pipe Lines, Ltd., Winnipeg, under a permit issued by the Saskatchewan government.

Westspur operates an interprovincial crude line between Cromer, Man., and Midale, Sask., where its proposed new system would have tied in. Federal law provides that the province has authority over lines exclusively within its boundaries while interprovincial lines are under dominion control. Saskatchewan argued that granting Westspur's application would place future lines in jeopardy of duplication.

Navy Plans Sunk

U. S. comptroller's ruling limits Navy's jurisdiction

WASHINGTON.—Claims by the Navy Department that it has the right to search for petroleum reserves on any land under its control were set back sharply last week by the U. S. comptroller general.

Naval petroleum reserves can be set up only by the President, Comptroller General Joseph Campbell ruled.

Campbell's opinion, written for Rep. Clair Engle of California, chairman of the House interior committee, climaxed a long fight by California oil men to block the Navy's plans to test San Nicolas Island, off the California coast, as a potential new reserve.

The island was set aside by the President in January 1933 only for "naval uses," Campbell ruled. It is "to be regarded as a naval reservation and not a naval petroleum reserve," he said.

The opinion effectively halts the Navy's oil search until it is specifically ordered by Congress and funds are provided.

Gulf of Mexico . . . But it left unsettled another important issue of "military land grabs" which is being fought by Engle and the Interior Department. This issue arose early this year when the Defense Department sought to have some 30,000,000 acres in the Gulf of Mexico set aside for military use. A substantial part of the acreage was in areas blocked out by the Interior Department for oil and gas leasing.

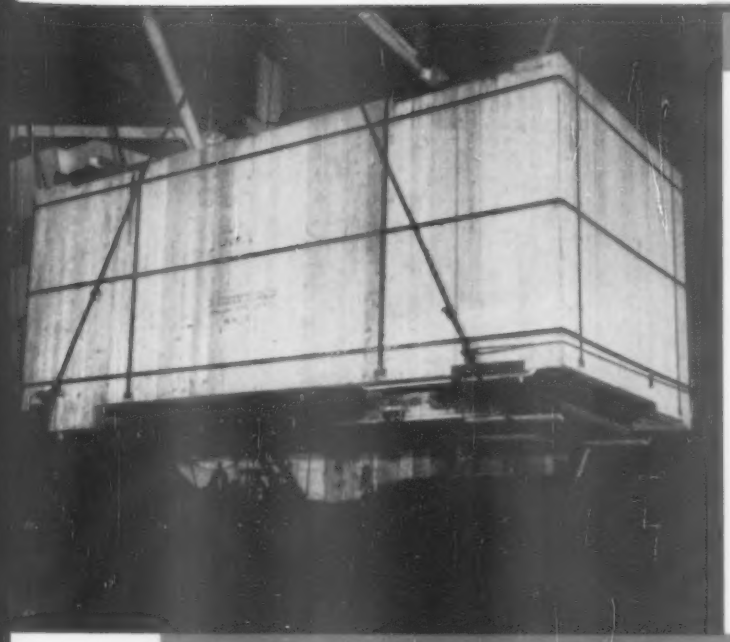
The Navy Department had been eying the oil possibilities of San Nicolas Island for 2 or 3 years before its plans for a test were disclosed last spring. Congress was asked for $529,000 for test drilling *(The Oil and Gas Journal, March 19, page 132)*.

Canada to Receive U. S. Gas

WASHINGTON. — The Federal Power Commission last week approved a request of the Pacific Northwest Pipeline Corp. to export an additional 20,000,000 cu. ft. of gas daily to Westcoast Transmission Co. at the Canadian border near Sumas, Wash.

Pacific Northwest already has a permit, granted a year ago, to export 12,000,000 cu. ft. daily while Westcoast was building its line to carry Canadian gas to the Pacific Northwest.

The permit was granted on the condition that service to U. S. consumers will not be impaired. Exports are expected to continue for about a year, when Westcoast's line is expected to be completed.



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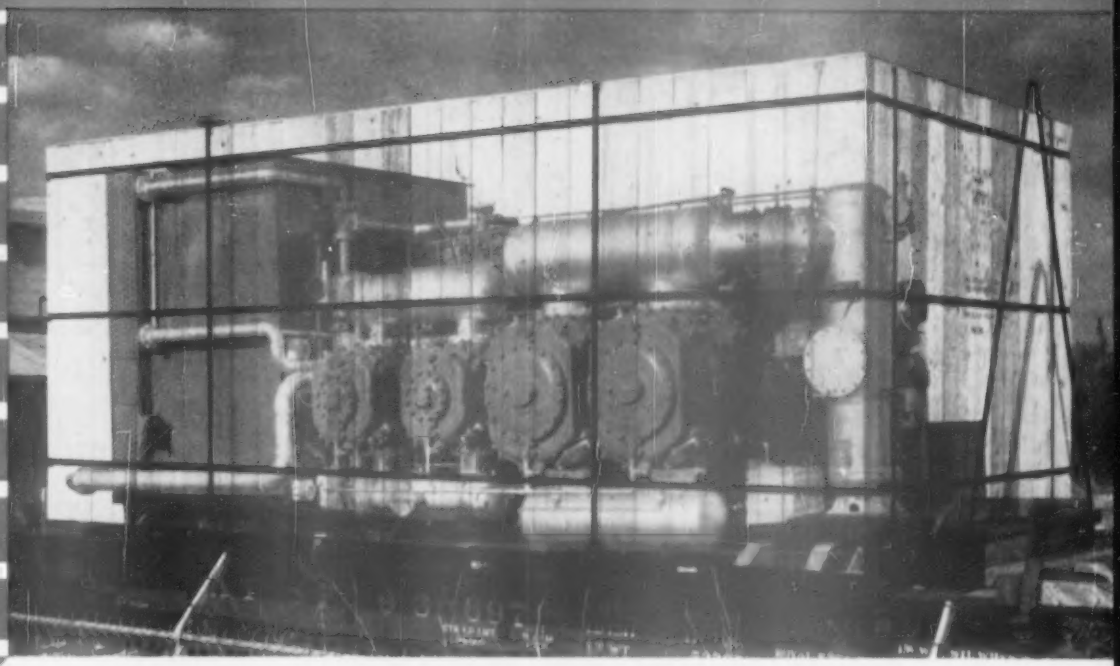

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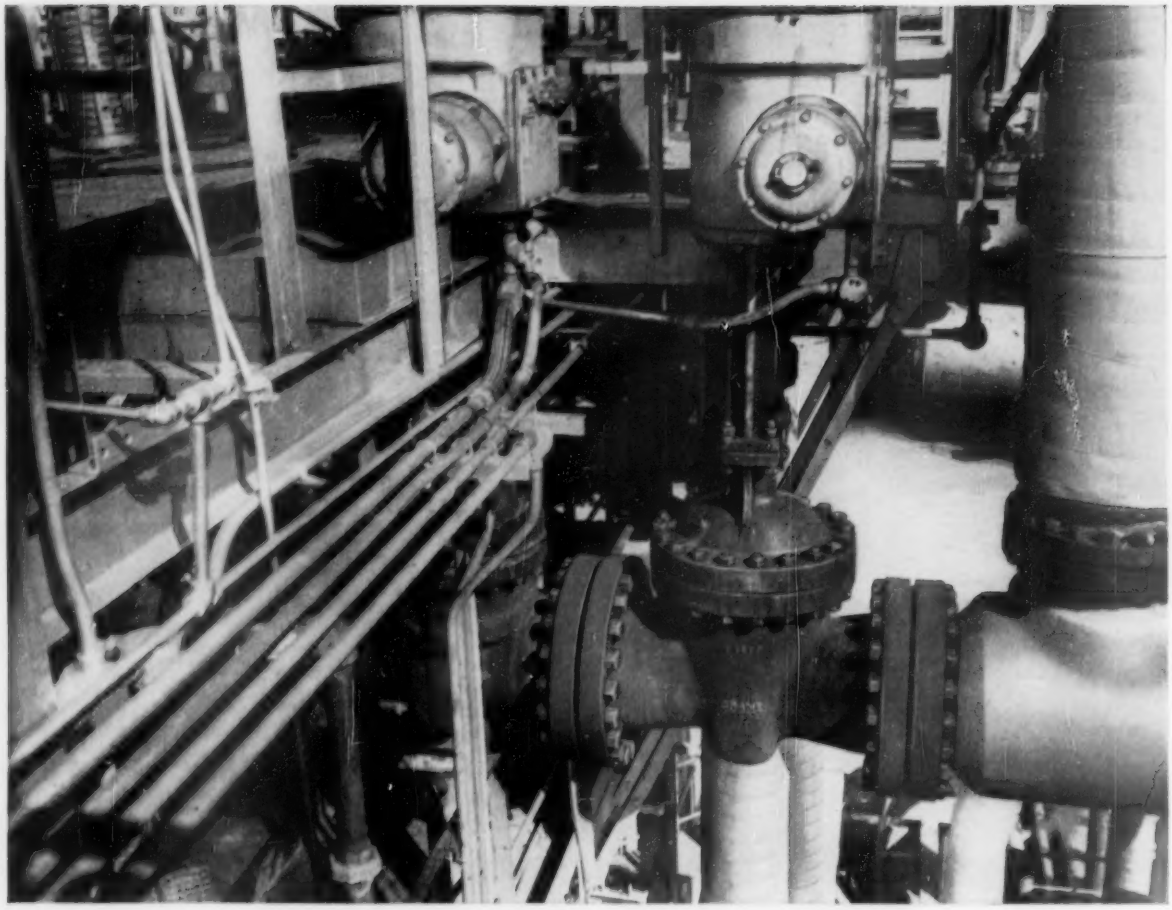


Tight, easy closure after 15 years on hot gas up to 1030° F.—with Crane valve

THE CASE HISTORY—Installed in a leading Southwest oil refinery, this Crane valve is beating its own record every day.

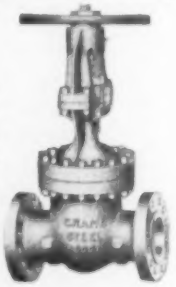
Since 1941, this 12 x 18-inch venturi 600-pound cast steel gate valve—with flexible wedge disc—has handled hot gas on an inlet line, from 900° F. to 1030° F. at 240 pounds pressure. It is motor-operated on a 6- to 8-hour cycle.

During the 15 years on this severe service, the *only* maintenance given this Crane valve has been routine during the scheduled unit shutdowns. The valve remains leak-free and continues to operate smoothly, with no repairs whatever to date.

This efficient flow-control operation is but one among thousands performed by Crane valves in oil refinery service—thousands of cases where Crane dependability has saved countless maintenance dollars and production time. What's back of such performance? *Proven* design—*proven* quality of materials—backed by more than a century's experience in valve development and manufacturing.

Don't take chances with your all-important valves—specify Crane to be sure of efficient performance.

Crane meets your every need in refinery valves—gates, globes, angles or checks—with screwed, flanged or welding ends—in sizes up to 24 inches—in pressure classes up to 2500 psi.



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Geologist Getting Broader Role

SAN ANTONIO.—Exploration is a much bigger word than it used to be. And the geologist, "if he is to continue to flourish," must be acutely aware of its new meaning.

This was made clear here this week by Robert L. Kidd, president of Cities Service Oil Co. of Bartlesville, Okla., who painted a graphic picture of how management looks at geology today.

Kidd said the geologist, while "still the anchor man of the petroleum-industry team," has new duties to management and his profession which make him far more than just an "oil hunter."

As a matter of fact, Kidd indicated strongly that knowing when not to find oil can be just about as important as knowing how to find it. The problem, he said, boils down to economics.

"In an integrated operation," he stressed, "oil and gas exploration is not quite as simple as merely finding and leasing prospects and drilling wildcat wells. Cash expenditures for exploration must be made to dovetail into and balance with many other projects."

ROBERT L. KIDD
. . . more than an "oil hunter"

Payout is problem . . . "We know that we must not only find oil and gas, but that we must also produce them in paying quantities. Payout periods of drilling ventures in proved areas have become lengthened with increased restrictions of proration."

Kidd emphasized the point by citing a recent case where a successful wildcat drilled by his company was assigned an allowable so low it made offset development unprofitable until the state regulatory body changed it after a formal hearing.

Superimposed, he said, on "this matter of delayed and diminishing revenues, we face the problem of increased drilling depths and costs." Time was when any mounting delivery costs would be offset by near-automatic and well-justified price increases. But not so today, Kidd declared.

The petroleum geologist, he said, must contend with an increasingly sterner set of economic facts. He listed the growth of the oil industry to world-wide proportions and increasing imports as two factors.

"As water seeks its own level," he declared, "so the availability of foreign oil and gas in substantial quantities has become a dominating factor in the price structure in the United States."

These "economic facts of life," Kidd said, must be solved by the exploration man and his industry associates.

"This means the geologist must develop a greater awareness of such economic factors as the potential return in terms of both time and money on each wildcat venture and make more accurate prediction of probable pay thickness, productive area, and acre-foot yield on all drilling projects.

Selectivity is key . . . "If the geologist keeps these hard economic considerations always in the back of his mind, he will be able to exercise greater selectivity in the exploration projects he wishes to push."

Speaking at the Gulf Coast Association of Geological Societies last week, Kidd reminded his audience that "during the last few years we have seen the art of exploration for oil and gas evolve rapidly into a complex science.

"We have seen great success record on a world-wide scale bring to the petroleum geologist general acceptance as a respected professional."

Kidd based his "viewpoint" on more than 30 years of experience with "a major oil company." Himself a geologist, Kidd was one of the pioneers in the use of geophysics in finding oil.

State Pipeline Tax Appealed

WASHINGTON.—Right of a state to tax an interstate pipeline will be tested in the U. S. Supreme Court.

The State of Alabama has asked the court to review a decision of the State Supreme Court holding that Plantation Pipe Line Co. was not subject to state taxes because it is engaged in interstate business.

The state attempted to tax the company on its 1952 business in Alabama, amounting to almost $17,000,000. It argued that the business done, the operations of employes in the state, and the 483 miles of main and lateral pipelines could not be considered exclusively interstate in character.

The state contends that taxation of intrastate property of an interstate company does not violate the commerce clause of the Constitution.

Nominations Down

U. S. buyers ask 100,216 bbl. daily of Alberta crude

CALGARY.—United States users of Alberta crude oil have asked for a daily average supply of 100,216 bbl. daily during the month of November.

Total nomination for Alberta crude during November is 396,992. This is somewhat below the 400,000-bbl. per day pace set by the industry during the past several months.

Of the total nomination, 193,190 bbl. daily will go east through the Interprovincial pipeline company, and 108,056 bbl. will go west via the Trans Mountain pipeline.

Imperial Oil, Ltd., continues as the big buyer, with nomination for 136,395 bbl. daily. British American Oil Co., Ltd., is next with a nomination for 65,155 bbl. daily.

Shell Oil Co. requested 51,785 bbl.; General Petroleum Corp., 33,461; and Canadian Oil Companies, Ltd., 29,000.

U. S. purchasers and their nominations are: Shell Oil Co., Anacortes, Wash., 40,000 bbl. per day; General Petroleum Corp., Ferndale, Wash., 33,461; International Refineries, Inc., Wrenshall, Minn., 8,330; Bay Refining Corp., Bay City, Mich., 6,000; Northwestern Refining Co., St. Paul Park, Minn., 6,000; Lake Superior Refining Co., Superior, Wis., 5,330; Dow Chemical Corp., Midland, Mich., 830; and Union Oil Co. of California, Cut Bank, Mont., 265.

Start of Crude Line Nears

LOS ANGELES.—Union Oil Co. of California expects to get its 225-mile 16-in. crude pipeline from San Joaquin Valley to Oleum on San Francisco Bay under construction by December 1. The company is acquiring right of ways and permits from approximately 350 property owners and lease and mortgage holders.

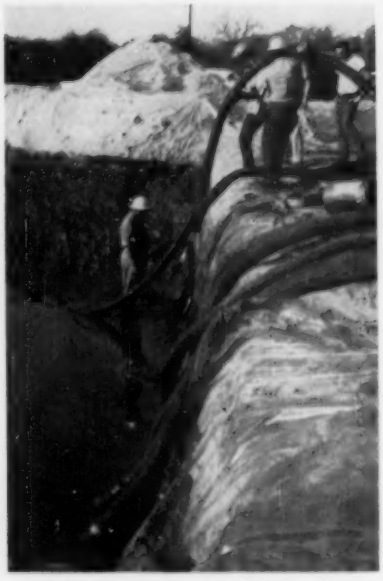
The line, with initial capacity of 75,000 bbl. daily, will release a tanker from the Avila-to-Oleum run. Additional booster stations will enable Union to increase capacity to 110,000 bbl. daily. A 12-in. section will connect the firm's Junction pump station to the 16-in. line at Coalinga.

PIT LINED with polyethylene film (top) provides storage for 2,200 bbl. of fracturing water at relative low cost. Below, workmen are removing pump-truck intake hoses from storage pit.

Film-Lined Pits Replace Tanks

A CHEAP new method for storing large quantities of water used in its Riverfrac hydraulic fracturing treatments has been developed by Dowell Incorporated. It consists of a pit lined with expendable polyethylene film.

The Dowell idea comes as one answer to a serious oil-field problem. The widespread use of fresh water fracturing treatments on oil wells has created a serious water storage problem at the well site. Some of the fracturing jobs require as much as 250,000 gal. of water. Steel tanks have been used for storage but they are difficult to transport and are relatively expensive.



What's the cost . . . Pits used by Dowell are easily constructed.

They are excavated by bulldozer with the bottom sloping toward one end. A sump is dug at the point where intake lines of pump trucks enter the pit, so that nearly all the water can be readily pumped out.

In a recent frac treatment near Hominy, Okla., a pit 55 by 75 ft. and about 8 ft. deep was dug by bulldozer. Two men lined it with polyethylene film in about 45 minutes. Then 2,200 bbl. of water was pumped into it.

Cost of the 8,000 sq. ft. of film used was $400 or about 5 cents per square foot. Digging and refilling the pit cost another $130. Thus the oil operator received storage for 2,200 bbl. of water at a total cost of $530. That is about the rental cost for a 1,000-bbl. steel storage tank.

The film being used is 0.003 in. thick, and is available in up to 80 by 400-ft. pieces.

It's flexible . . . The storage pits also have other uses around the well. Two of the more common cases are:

. . . **During swabbing** operations after the fracturing treatment has been completed.

. . . **During production** for salt-water storage.

In any event after the storage pit has served its purposes, the operator easily can roll up the film liner and refill the pit.

Gas Case Revived

Fair field price issue goes before high court again

WASHINGTON. — The U. S. Supreme Court was asked again last week to say how the Federal Power Commission must figure to allow fair field price for natural gas.

The court was asked to reconsider its order of October 8. It denied Panhandle Eastern Pipe Line Co. a review of the decision of the District of Columbia Circuit Court that the traditional rate-base method of determining prices must be used at least as a "point of departure."

The FPC granted Panhandle the fair field price in June 1954 on gas it produced itself. The City of Detroit and Wayne County, Michigan, appealed the decision to court. The lower court held that the FPC could consider the need for encouraging pipeline-company discovery and development. But it ruled the commission must use the conventional rate-base method as a basis of comparison and limit a higher price to no more than is necessary as an incentive for pipeline-company production *(The Oil and Gas Journal, December 26, 1955, page 125).*

Panhandle appealed to the high court for review of that decision last May. It told the court the rule laid down in the 1955 decision was unworkable.

After the Supreme Court denied review last month, Panhandle asked for a stay, which was refused. It then filed its petition for reconsideration.

Gulf Oil Cuts Rocky Staff

DENVER.—Gulf Oil Corp. is cutting its Rocky Mountain area staff in half.

Between 80 and 90 employes in the geophysical and geological departments will be dismissed or transferred by January 1, according to A. M. Bell, Denver district manager. Those affected now work out of district offices at Billings, Mont.; Casper, Wyo.; Salt Lake City, Utah; Durango, Colo.; and Denver.

Gulf will continue exploration work in the Rocky Mountain division "with more emphasis on wildcatting. These changes will have no effect on our production branch."

Younger employes with little experience will be dismissed, but most of the affected workers will be transferred to other company divisions, including Houston and Fort Worth, Tex., and Venezuela.

Gulf's Rocky Mountain division stretches from Canada to Mexico and from eastern Colorado to the Sierras.

For a big, tough clearing job– the biggest, toughest tractor –the D9

This CAT* D9 Tractor is clearing a 50-foot right-of-way through the rugged Blue Mountains of Oregon for Pacific Northwest's 22-inch natural gas line.

To pioneer in the frozen rock, clay and snow, Fulghum Contracting Corp., LaGrande, Ore., used the biggest of the big yellow machines. It has done everything asked of it. Reports Jerry Muldowney of Fulghum, which has 45 other Caterpillar-built units on the job:

"It's doing a very impressive job, particularly on the many side cuts and steep grades. We work it in second gear in rock and third everywhere else."

And here's important news about the D9 for pipeliners. Now you'll get even more production from this giant. *Its Turbocharged engine output has been increased to 320 HP at the flywheel!*

Here's one way to figure the production you get from a D9 equipped with a big No. 9A Bulldozer. On a 50-foot haul, this unit can handle 610 loose cubic yards per hour. This figure can be increased as much as 75% in downhill 'dozing and trenching!

This is a unit that can produce no matter where the pipe takes you. It is equipped with oil clutch or torque converter drive. Steering clutches and air-cooled steering brakes are power boosted. It has a heavy-duty 7-roller track frame and long-lived specially hardened track shoes. It's built for high production no matter what the climate or terrain.

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Youngstown Electric Weld Line Pipe saves time and trouble because it's made in long lengths. These long lengths, of course, result in minimum handling and welding—that speeds up installation and reduces pipe line costs.

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Blue-Chip Leasing

Companies poised for "land rush" in expensive Persian Gulf; Kuwait grants due by next month, Iran may follow

FUTURE offshore leasing in the Persian Gulf promises to make the blue-chip payments made for underwater lands of the United States' Gulf of Mexico area look like penny-ante play.

The companies involved in the competition for the underwater lands offsetting some of the world's most prolific oil fields are inclined to wince if the term "scramble" is applied to their efforts to get there first. But, all indications point to just such a scramble for the remaining acreage lying offshore from the Middle Eastern oil domains of the world.

The tiny shaikhdom of Kuwait plans to award offshore concessions in the Persian Gulf by sometime in November. The Shaikh of Kuwait indicated last February that he would be happy to look at bids for concessions on the acreage of his tiny kingdom. It has become evident that several companies are interested *(The Oil and Gas Journal, October 15, page 106).*

The ruler of the tiny Middle Eastern kingdom is using the same psychology which Venezuela put to such good use in the past several months. He is asking for bids with no assurance whatever that the highest bid will be accepted. He has promised only that he'll "take a look" at the bids, select those he regards as most advantageous, and then give this select few a chance to better the original bids in order to come out on top.

A number of the biggest companies in the world are sitting in on this game. Several independents have indicated an interest, but few of them have the chips to play for long in the kind of a contest that the shaikh has outlined.

Only British Petroleum Co., Ltd., and Gulf Oil Corp. have specifically said they are not interested. The two major world oil companies have joint ownership in the land concession of Kuwait. Their concession extends up to 6 miles into the Persian Gulf. The jointly owned Kuwait Oil Co. is now producing 1,175,000 bbl. daily and seems to be well satisfied with its prospects for future expansion without the necessity of acquiring expensive wet feet.

With the exception of Kuwait and the Kuwait-Saudi Arabia Neutral Zone, the western offshore waters of the Persian Gulf are pretty well accounted for. The major question still to be answered as far as these western waters is concerned is just where those boundaries between Kuwait, Saudi Arabia, and the Neutral Zone fall, particularly offshore.

Saudi Arabia . . . There is no question about operations in the Persian Gulf waters off Saudi Arabia. Arabian American Oil Co.'s original concession includes that area eastward from the Saudi shoreline to the center of the Persian Gulf.

It is in this offshore region that Aramco is developing Safaniya, one of the largest offshore oil fields in the world.

Aramco has drilled 17 wells in the field which is 20 miles long and 7½ miles wide and extends 10 miles offshore. The company is now building a pipeline to link the field and the Ras Tanura refinery. Aramco plans to put the field in production with a daily output of 125,000 bbl. by late 1957.

Qatar . . . South of the Saudi Arabian offshore operation, the Royal Dutch-Shell group holds the concession on the offshore areas in the Qatar region.

Shell's first well, Matbakh 1, 5 miles off the east coast of the peninsula and about 35 miles north of Doha, was abandoned dry at 6,700 ft. The same drilling platform has been towed to a second location at Idd el Shargi, about 50 miles east of Doha, for another well in 50 ft. of water.

The Trucial Coast . . . A two-company operation owned jointly by British Petroleum and Cie. Francaise des Petroles is probing the Persian Gulf waters off the Trucial Coast kingdoms of Abu Dhabi and Dubai.

The operation, owned two-thirds by B.P. and one-third by C.F.P., has carried out seismic work and a core-hole drilling program of the seabed in the 12,000-sq. mile area.

The first deep test of the area will be drilled early next year 20 miles off the island of Das, 60 miles from the Arabian mainland from a DeLong barge now being constructed in Germany at a cost of $1,900,000 *(The Oil and Gas Journal, July 9, page 73, and August 27, page 81).*

Gulf's eastern shore . . . Like many of the land areas in the Middle East, the Persian Gulf's waters have no definite boundaries as far as its bordering countries are concerned.

It has been presumed that the countries along the Gulf's western shoreline will eventually reach an agreement with Iran on a dividing line which runs down the center of the gulf. This, however, has not yet been done. Iran controls all the territory bordering the Persian Gulf on the east.

There have been persistent reports from Iran in the past few months that the country is poised to take action similar to Kuwait's on its offshore waters. The reports were pointed up early this month when the Shah of Iran urged his government to push such a search for oil in offshore waters in a speech made at the opening of the Iranian Senate.

A number of executives of major American and European oil companies are known to have made visits to Teheran with such concessions as a prize.

The Iranian concession of the old Anglo-Iranian Oil Co. runs along the eastern shore of the gulf. This concession, now operated by the consortium of international companies, includes the subsea lands out to 3 miles from the shoreline. Any concessions offered by Iran to any company or group of companies would presumably extend from that 3-mile line out to the center of the Persian Gulf.

Costa Rica Opens Two Areas

Costa Rica has opened two new areas for petroleum exploration and exploitation. One is in the Province of Heredia, just north of the capital city, San Jose, and the other is in the Province of Puntarenas, where the Pacific port of the same name is located.

Nine major American oil companies are reported to be interested in the new areas and are expected to ask for bids for exploration and exploitation rights. They include Union Oil of California, the only company now operating in the country.

Union has found oil on its Limon concession, but the find has not yet proven to be commercial. In addition to the Limon concession, bordering on the Caribbean and Panama, Union also has a concession in Guanacaste Province, bordering on the Pacific and Nicaragua.

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Japan Goes Offshore

Four promising structures located, test program set

AN extensive geophysical survey of offshore waters in the Sea of Japan has revealed at least four promising structures which will be tested in an intensive program of offshore drilling.

The survey, conducted by Geophysical Services, Inc., for Sekiyu Shigen Naihatsu Kaisha (Petroleum Resources Development Co.), involved work at more than 900 locations off Japan's western coastal areas.

G.S.I. has reported the four structures to the semigovernmental agency as the most promising found. They extend for 36 miles from Tsuchizaki to Hirasawa in Akita Prefecture.

Tsuchizaki is near Yabase, Japan's best producing field. Yabase, with a daily output of 3,750 bbl., accounts for more than half of Japan's total production of 5,800 bbl. daily. G.S.I. has reported that all the structures lie about 2½ miles offshore and appear to be tertiary beds similar to Yabase.

A full-scale offshore drilling program to investigate the structures is scheduled to begin early in 1957.

In addition to the underwater exploration work, the development company is doing exploratory work at Hiratori and at Noboro on Hokkaido, the island north of Japan's mainland, and in areas near Innai and in Niigata Prefecture.

Iraq Will Process Sulfur

The Iraqi Government will ask for bids next month on a $4-million plant at Kirkuk to extract from 300 to 350 tons of sulfur daily from what is now waste natural gas produced in connection with Iraq's oil.

Construction of the plant was recommended by the government's development board after the project was urged by both British economists and Arthur D. Little, Inc., American firm of consulting engineers.

Reports from Baghdad last week said contractors will be allowed 3 months to submit offers.

African Tests Under Way

Shell-B.P. Petroleum Development Co. of Nigeria has started two more wells that may help determine whether earlier discoveries are commercial finds.

One test is under way at Afam, 25 miles east of Port Harcourt. It is in the same vicinity as Oloibiri 1, which earlier this year brought in the first "good show of free oil" found in Nigeria.

The company said that 18 more months of drilling were needed to confirm the discovery.

The second test is north of Port Harcourt, near Awka in Onitsha Province. It will further test Akukaw structure, where high-pressure gas was found last year.

French Well Tested

Drill-stem test yields 30 bbl. per day at Esso well

ESSO STANDARD S.A.F. recovered 37°-gravity crude oil at the rate of about 30 bbl. daily last week on a drill-stem test of its newest discovery, Lucats 1, located near the Parentis field in southwestern France.

The affiliate of Standard Oil Co. (N. J.) encountered its first show in the well nearly a month ago *(The Oil and Gas Journal, October 15, page 105)*.

The test is about 4½ miles southeast of Parentis 1, the most prolific field yet found in France.

Esso tested tight limestone intervals at 6,704-6,917 ft., with tests yielding about 7 bbl. of oil in 5 hours, without acidization. The well is being deepened before further tests are made.

The 37°-gravity crude recovered is lighter than that produced in the much more prolific Parentis wells. The Parentis crude is slightly more than 32°-gravity oil.

Argentina Attracts Europeans

European firms, most of them virtually unknown to the oil-industry equipment and supply field, are apparently determined to gain a foothold in Argentina.

European companies offered Argentina much more liberal financing terms than did established British and American companies in 71 preliminary bids for oil projects.

Yacimientos Petroliferos Fiscales, the government oil agency, asked for the bids in May. Y.P.F. wanted to get an idea of the response to its request for long-term financing offers to build pipelines and processing installations in Argentina *(The Oil and Gas Journal, May 14, page 119)*.

Y.P.F. specified it was not interested in financing terms of 5 years or less, but most of the bids from American firms fell into that category.

Italian, German, French, and a few British and Japanese firms extended credit terms far beyond that period.

Indonesia Reversal

Government changes mind, keeps Dutch-Shell fields

THE Indonesian Government said last week in Djakarta that it has decided against returning the North Sumatra oil fields to Bataafsche Petroleum Maatschappij.

The government announcement was directly counter to unofficial reports that came out of the Indonesian capital 3 months ago. Then it was reported that an agreement had been reached to return the fields to the Royal Dutch-Shell company.

Shell officials in New York declined to comment on the situation last week. Press reports from The Hague said Shell Group spokesmen there also declined to discuss the latest Indonesian move.

The 10 northern Sumatra fields were producing about 20,000 bbl. daily of high-gravity crude before World War II. When the Japanese withdrew from northern Sumatra, they turned the fields over to Tambang Minjak, a locally organized oil-producing enterprise.

Government's view . . . The Indonesian Government has never seriously disputed the legality of B.P.M.'s concession and its right to operate the fields. But it has never pitted its admittedly weak authority over the northern areas of Sumatra in an effort to return the fields to B.P.M.

Members of the Indonesian Parliament have long contended that the fields were destroyed by the Japanese and the production that is now coming from them can be credited to the Indonesian enterprise.

Indonesian nationals active in coaxing meager production from three of the fields, Rantau, Pulau Tabuan, and Djulukurajeu Atjeh, have claimed recently they are producing about 150 bbl. daily. Even these figures are viewed skeptically by those familiar with the operation.

Guatemalan Awards Grow

Exploration concessions granted by the Guatemalan Government under its new petroleum code passed the 6,000,000-acre mark last week as three more companies received acreage.

The latest awards, which brought the number of separate concessions to 17, were all in the northern province of El Peten. They included 304,321 acres to Esso Standard (Guatemala, Inc.); 241,992 acres to Petroleos Atlas de Guatemala, a locally organized Guatemalan firm; and 472,474 acres to Guatemalan Atlantic Corp., a subsidiary of Atlantic Refining Co.

World Output at Peak

Venezuela, Canada set pace as free world oil production hits new high; U. S. increase offsets Middle East decline

CRUDE output in free-world countries rose to a record 15,130,100 bbl. daily in August, due largely to a gain in the United States to its highest level since March.

U. S. output rose 105,000 bbl. daily to 7,195,000 bbl. This increase, plus an over-all gain of 52,800 bbl. to 3,601,800 bbl. daily in other Western Hemisphere oil producing countries, made up for a decline of 120,300 bbl. in the Middle East to 3,685,800 bbl. daily.

Venezuela set a record for the third straight month as companies increased output 5,300 bbl. to 2,465,500 bbl. daily. This brought the 8-month average to 2,388,100 bbl. daily, a gain of 271,400 bbl., or 12.8 per cent over the same period last year.

Canadian output rose 38,700 bbl. to a record 498,000 bbl. daily. A big factor in the rise was the settlement late in July of the strike at Shell Oil Co.'s Anacortes, Wash., refinery. Alberta had set two allowables during the walk-out. The higher went into effect after settlement. The 50,000-bbl. refinery operates exclusively on Canadian crude taken from Trans Mountain pipeline.

Middle East off . . . The four major Middle East producers shared in the month's decline in that area. Iran reported the biggest drop, down 54,000 bbl. to 543,000 bbl. daily, the lowest since March.

Arabian American Oil Co. produced 1,005,900 bbl. daily, off 27,700 bbl. But it was the eleventh consecutive month that Saudi Arabian output has been over the 1,000,000-bbl. daily, up 10.2 per cent from a year ago.

Kuwait Oil Co., Ltd., produced 1,180,500 bbl. daily, down 24,200 bbl. The 8-month average of the joint Gulf Oil Corp.-British Petroleum Co., Ltd., operation was 1,176,800 bbl. daily, up 70,800 bbl. from last year. At midyear, output came from 147 wells flowing from Middle Cretaceous sandstone in Burgan field and from 53 wells flowing from the same formation in Magwa/Ahmadi.

Output in Iraq was off 11,900 bbl. to 751,900 bbl. daily. Iraq Petroleum Co., Ltd., produced 539,500 bbl. daily from Kirkuk and nearby fields. Its affiliate Basrah Petroleum, produced 182,200 bbl. daily from Zubair and Rumaila fields. Mosul Petroleum, another affiliate, produced 26,400 bbl. daily from Ain Zalah and Butmah. Naft Khaneh, operated by British Petroleum, accounted for the balance of the country's production.

Egypt climbs . . . In Egypt output passed the 40,000 bbl. daily level for the first time since November 1953. The upward swing was due to increased production by International Egyptian Oil Co., Inc. Its Belayim field produced 8,700 bbl. daily, and Feiran, 700 bbl. daily.

Output has been fairly steady in recent months from Egypt's older fields. In August, Ras Gharib produced 22,500 bbl. daily, and Hurghada, 700 bbl. daily. The fields, on the western shore of the Red Sea, are operated by Anglo-Egyptian Oilfields, Ltd. In fields in the Sinai Peninsula, jointly held by Anglo-Egyptian and Socony Mobil Oil Co., Inc., output was: Ras Sudr, 5,800 bbl. daily; Asl, 3,300 bbl. daily; and Ras Matarma, 300 bbl. daily.

TREND OVER THE LAST YEAR

1955—	Western Hemisphere less U. S.	Middle East	Total, non Communist countries
August	3,140.4	3,241.4	7,002.6
September	3,130.9	3,256.9	6,990.7
October	3,179.6	3,378.2	7,166.0
November	3,255.0	3,386.0	7,248.3
December	3,298.5	3,316.1	7,227.2
1956—			
January	3,363.7	3,392.6	7,368.5
February	3,426.2	3,415.7	7,453.4
March	3,471.2	3,624.3	7,713.8
April	3,320.5	3,736.6	7,690.8
May	3,356.5	3,793.9	7,788.1
June	3,519.1	3,713.7	7,871.7
July	3,549.8	3,806.1	7,996.6
August	3,601.8	3,685.8	7,935.1

Crude Production Around the World

(Daily average in thousands of barrels)

Country—	August 1956	July 1956	August 1955
Western Hemisphere:			
Argentina	84.2	84.2	84.3
Bolivia	8.8	8.6	8.4
Brazil	9.3	6.0	5.4
Canada	498.0	459.3	382.0
Chile	10.2	10.0	7.5
Colombia	125.5	122.9	108.6
Cuba	1.7	1.5	1.0
Ecuador	9.7	9.7	10.0
Mexico	260.0	260.0	248.8
Peru	49.9	49.9	46.8
Trinidad	79.0	78.5	68.0
Venezuela	2,465.5	2,459.2	2,169.6
Total	3,601.8	3,549.8	3,140.4
W. Europe & Africa:			
Algeria	0.5	0.5	1.1
French Morocco	2.0	2.0	1.9
Egypt	41.7	37.9	34.0
Austria	63.4	63.4	70.0
France	25.2	24.4	20.7
West Germany	69.7	69.2	63.2
Italy	13.0	11.5	5.1
Netherlands	20.9	21.1	19.4
Turkey	6.0	6.0	3.9
United Kingdom	1.2	1.2	1.2
Yugoslavia	5.8	5.5	4.8
Total	249.4	242.7	225.3
Middle East:			
Bahrain	30.0	30.0	30.1
Iran*	543.0	597.0	358.0
Iraq†	751.9	763.8	724.7
Israel	0.7	0.6	
Kuwait	1,180.5	1,204.7	1,046.2
Neutral Zone	46.0	46.0	26.8
Qatar	127.8	130.4	115.4
Saudi Arabia	1,005.9	1,033.6	940.2
Total	3,685.8	3,806.1	3,241.4
Other Asia:			
British Borneo	117.0	117.0	111.7
Burma	5.2	5.2	2.6
India	7.5	7.5	7.5
Indonesia	250.0	250.0	253.0
Japan	5.9	5.8	6.3
New Guinea	6.8	6.8	8.5
Pakistan	5.7	5.7	5.9
Total	398.1	398.0	395.5
Total Free World:			
Foreign	7,935.1	7,996.6	7,002.6
United States	7,195.0	7,090.0	6,665.0
Free World Total	15,130.1	15,086.6	13,667.6
‡Communist Countries in Soviet Orbit:			
Romania	200.0	200.0	150.0
Russia	1,600.0	1,600.0	1,300.0
Others	50.0	50.0	36.8
Total	1,800.0	1,800.0	1,486.8
World Total	16,930.1	16,886.6	15,154.4

*Includes estimated 4,000 bbl. daily from Naft-i-Shah field not operated by consortium companies.

†Includes estimated 3,800 bbl. daily this year and 12,000 bbl. daily in 1955 from Naft Khaneh field, operated by British Petroleum Co. rather than I.P.C.

‡Revised estimates.

Figures are from reliable reports in the industry or official government sources. Data for Russia and Eastern Europe are based on competent estimates; no authentic information is available on month-to-month production in these areas. Estimates also have been made for other countries, particularly in Southeast Asia, where complete current reports are lacking. Communist countries in the Soviet orbit include satellite countries in Europe and Red China.

Syrian Strike Being Deepened

J. W. MENHALL is deepening his wildcat discovery in the northeast corner of Syria which has added that country to the world's oil-producing nations.

The well is in Karatchok about 25 miles from Ain Zalah field in Iraq and about 10 miles from the Turkish and Iraqi frontiers.

MenHall reported last week 150 ft. of pay was topped at 6,650 ft. Oil filled to the top through 8⅝-in. casing. The well was not acidized because of plans to continue drilling. Gravity of the crude has not yet been determined, but it is the first known production in the country.

A Syrian by birth, MenHall is owner of the J. W. MenHall Drilling Co. of Benton, Ill. He and associates hold a concession over about 6,000 sq. miles of northern Syria through Syrian American Oil & Gas Co. He has shipped two rigs and a spudder to the country, and the wildcat is the first well drilled.

An affiliate of Iraq Petroleum Co., Ltd., gave up most of a concession in Syria in 1951 after spending $17 million and drilling 11 wells with little show. The remaining acreage was given up in 1954.

One other company currently has prospecting rights in Syria. It is Soc. des Petroles "Concordia" of Damascus, an affiliate of Deutsche Erdoel, A.G., a West German firm which has an area of 5,800 sq. miles.

Star to pay $1,965 an acre . . .

Record Venezuelan Bid Made

STAR OIL CO., mysterious newcomer in the Venezuela oil industry, has bid what is believed to be an all-time high for an exploitation concession in that country. It offered $1,965 per acre for a 21,400-acre concession in the Mara field. Mara field is northwest of Maracaibo in the state of Zulia.

At the same time, Star bid $785 per acre for 24,700 acres in Block 9 in Lake Maracaibo, also an exploitation concession. This indicates that it regards the Mara area as two and one-half times as valuable as the more extensively developed lake region.

In addition to these per-acre offers, Star agreed to a 20 per cent royalty and to refine 30 per cent of the oil in Venezuela. The latter qualification would force it to tie up with one of the companies now refining there or to erect its own refinery.

Star also sought 98,800 acres in Apure, the vast state bordering Colombia on the south. This area is south of the shut-in production in the Barinas-Apure basin. This bid was not accepted.

Deal has time limit . . . Its agreement with the Venezuelan government requires Star to submit development plans on its allotted concessions. It must do so in 2 months for the Maracaibo concession but it has up to 8 months in the Mara field. Payment for the concessions must be made when plans are submitted. Therefore Star must ante up $19,400,000 in 2 months and an additional $42,000,000 6 months later.

On a per-acre basis, its total bid of some $61,500,000 well eclipses others made recently. Except for one Venezuelan Leaseholds' bids for approximately $1,800 per acre in Lake Maracaibo, all were in the neighborhood of $1,000 for lake exploitation concessions. Exploration concessions elsewhere were in the neighborhood of $18 per acre.

Previously accepted bids totaled $312,000,000. Star's obligations raise the total to $373,500,000.

The company . . . The air of mystery surrounding Star results from the lack of public knowledge of its origin and backing.

Joseph Davidson, Washington attorney, is the president. No other officers of the firm have been publicly identified, nor have the financial backers been revealed.

International BRIEFS

Geological work in the Republic of Panama is scheduled by Texas American Oil Corp., Midland, Tex., during a 6-month option just acquired in a 1,152,938-acre concession. Caribbean American Petroleum Corp. of Panama, S. A., will handle the operation for the parent company. Purchase was made from Mas Petroleo de Panama, S. A.

Shell Prospecting Co., Ltd., has applied for a permit for extensive surface exploration in Bolivia, according to reports from La Paz last week.

No details of the size of the tract sought by the Shell company have been revealed, but press reports said it included lands in the departments of Tarika, Chuquisaca, Santa Cruz, La Paz, and Beni.

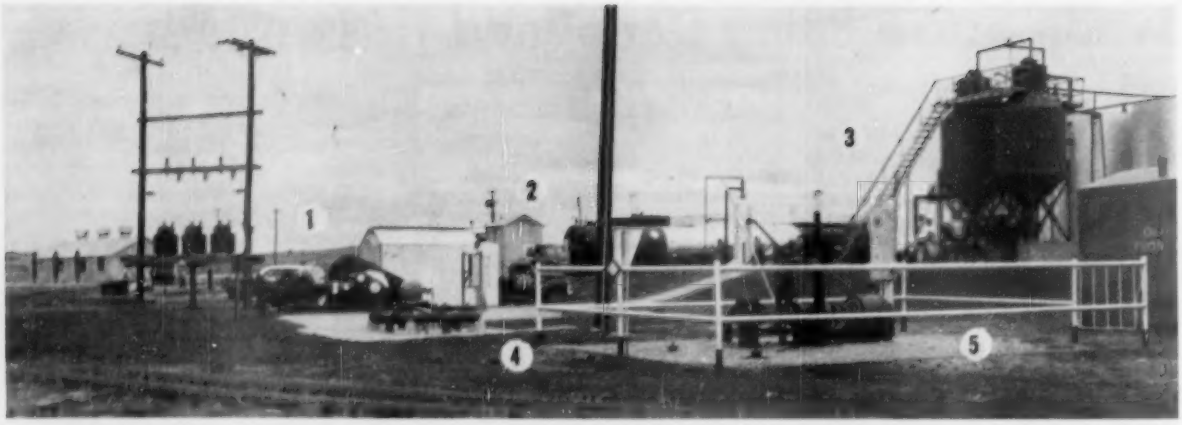
The new cracker at the Hamburg, West Germany, gas works will process 7,200 M.c.f. daily of refinery gas from the local 46,000-bbl. daily Esso A.G. plant into 10,600 M.c.f. daily of town gas. The unit is scheduled to go on stream November 1.

British Petroleum (Kwinana), Ltd. will spend almost $8 million on a new expansion program at its 70,000 bbl. daily Australian refinery. Principal new processing unit to be added will be a 10,000-bbl. Platformer. The refinery already has 6,000 bbl. daily platforming capacity. Additional storage will account for the remainder of the expenditure.

The largest tankers ever built in Belgium have been contracted at the Cockerill Ougree shipyard in Hoboken by Nederlandsche Pacific Tankvaart Maatschappij (Caltex). The company has ordered two 45,000-ton tankers, each 715 ft. long with a beam of 105 ft. and a depth of 50 ft. The first is scheduled for delivery in 1960. The two will increase the Caltex Dutch fleet to 19 tankers.

Petroleos Mexicanos is now marketing its new high-test 90-octane gasoline in Mexico's West Coast cities and towns in the agricultural states of Sonora, Sinaloa, Nayarit, and Baja California.

The new gasoline is moving from the Minatitlan refinery through pipelines across the Isthmus of Tehuantepec to Salina Cruz on the Pacific. From Salina Cruz it is shipped by tanker to consumption centers in Northwest Mexico.



TWO PIPELINES take custody of the crude from North Burbank unit automatically. About 5,000 bbl. per day is being run. (1) Phillips Pipe Line pump, (2) control house, (3) metering tanks, (4) pipeline manifold, (5) Mid-Continent Pipe Line pump. Fig. 1.

Here's how Phillips approached

Automatic Lease Custody Transfer

Phillips is now operating an automatic-custody-transfer battery at the North Burbank unit in northern Oklahoma. By means of two alternating 94-bbl. metering tanks it is handling 5,000 bbl. of crude per day. Both Phillips Pipe Line and Mid-Continent Pipe Line are receiving the crude. Possible savings in equipment for this battery amount to $70,000; savings on a 300-bbl. per day battery would be about $2,000. Other savings are an increase in crude-oil gravity of 0.2° to 0.5° by reducing evaporation, elimination of tank-bottom losses, and reduction of the size of pumping installations.

by G. G. Hebard

IT has long been the dream of the oil industry to sell its crude-oil production by some form of metering system rather than by conventional gaging methods. The gaging method with all of its shortcomings has, through years of use, become the custom of the industry. Evaporation losses, human errors, intermittent and uneconomic loading of lines, large power installations, tank-bottom losses, voluminous tankage, and uneconomic use of labor, all a natural result of the gaging system, have been accepted because of custom.

Some years ago, a few pioneering souls attempted to prove the feasibility of the use of meters and metering devices in oil-production operations. The efforts were, as a whole, discouraging; results were inconclusive; and, in general, the opposition of pipeline companies and, for that matter the producers themselves, caused the movement to die on the vine. Now, spurred by the present trend toward automation and encouraged by its success in mass production, oil producers have renewed their efforts.

This time, the experimental work was based upon a sounder foundation, and from it have evolved several systems that are receiving widespread interest and are apparently overcoming the opposition previously encountered.

Measuring system . . . The basic system that has received the widest acceptance is the weir principle of establishing positive and accurate levels in a calibrated measuring vessel. To further develop the movement, the A.P.I. set up a working group to study the problem and establish codification of acceptable principles. This working group brought together producers and pipeline people and served to stimulate an interest in the project which has resulted in many oil companies making experimental installations embodying almost as many designs and as many variations in arrangement of components as there were companies involved.

Phillips Petroleum Co.'s approach to the problem was first to employ the basic weir system in design; second, enlist the cooperative aid of an interested pipeline company in the design so that all of its ideas and requirements were complied with; and third, place the system in actual operation of selling oil after a very limited shakedown run. The philosophy of this third point was that enough experimental work had been done and that any true deficiencies of the system would be brought out and corrected only by actually using this method of selling our oil.

Agreement to sell . . . Once the basic schematic design work was completed, the job of selling the system began. It was necessary to present the designs to state regulatory bodies, to Indian agencies, to the federal Department of Interior and convince each that the system was legal, accurate, and reliable. In addition to this, it was necessary to do missionary and educational work on several pipeline companies, and on our own personnel. In this pioneering stage of automatic lease custody-transfer operations, it has been found that as much salesmanship as engineering

Author is design engineer, Phillips Petroleum Co., Bartlesville, Okla.

PRODUCING

is required. It was no simple matter to convince tradition-bound production people, pipeline companies, and regulatory bodies that the system was sound, accurate, reliable, and troublefree.

Automatic-Custody Battery

Now operating . . . Phillips has designed and is installing three automatic-custody batteries. These differ in detail but fundamentally, they are all weir systems. The North Burbank Unit installation and operation described is in actual operation selling oil to two separate pipeline companies.

Figs. 1 and 2 show the over-all layout and general arrangement of the North Burbank custody-transfer installation.

Surge vessels which in this case consist of two 500-bbl. tanks take crude oil from the treater. A transfer pump picks up oil from the surge tanks and delivers it to two metering vessels. From the metering tanks, the oil is delivered to a manifold where it is directed to either Phillips Pipe Line or to Mid-Continent Pipe Line in accordance with delivery contracts. The manifold is manually operated since the deliveries are to either pipeline for specified periods, which may vary from time to time. A pump continuously circulates oil from the surge tanks to the control house to monitor b.s. and w.

Metering tank . . . Fig. 3 is a detail of the metering tank. Here is a vessel which has a 45°-cone top and bottom. The top cone is truncated under a dome and in itself comprises the top weir.

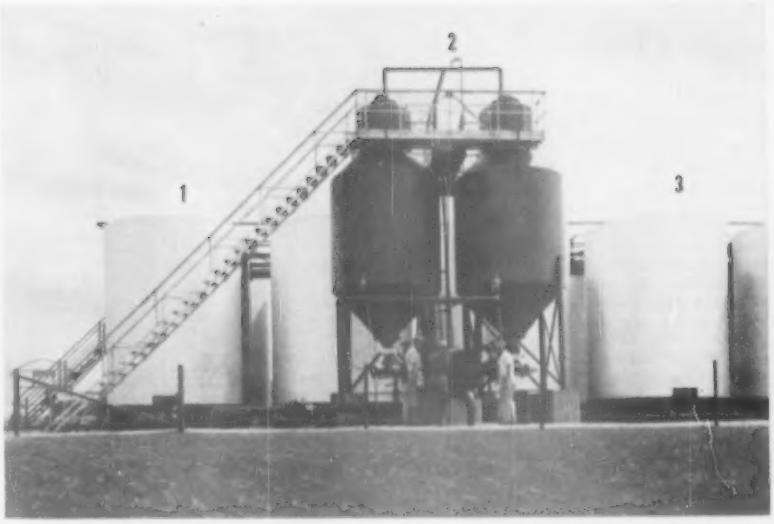
The vessel fills to float 5 which actuates and closes the inlet valve. Then drain valve 7 opens, allowing excess fluid to drain back to the surge tank and continues to drain until float 6 opens pipeline valve 6 and closes valve 7.

Valve 6 remains open until float 4 drops. Delayed action of valve 6 insures drainage of all oil past valve 6.

The fluid enters the tank tangentially giving a rotating motion to facilitate better degassing and cleaning of walls. The upper cone promotes movement into the dome without trapping of gas pockets.

On draindown, there is no problem of dribble as is the case of a weir box in a conventional tank. Here there is only a 20-in. diameter which must level off. On a surface this small, accuracy cannot be impaired by fluid meniscus.

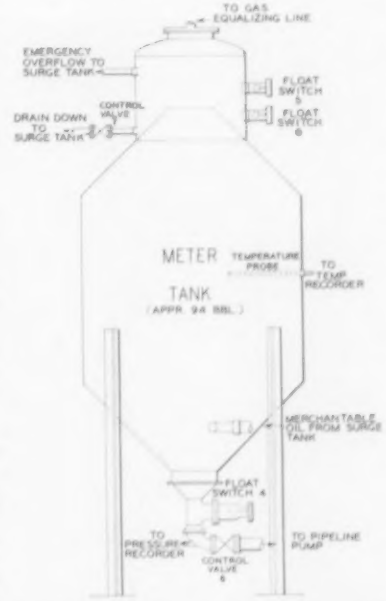
Tank calibration is from the top weir to valve 6. In our case, the metering tanks were plastic-lined to minimize incrustation or wall buildup. On emptying, the tank flushes completely so there can never be bottom buildup. A 20-in. cover plate and a 20-in. bottom flange permit straight-through inspection or cleaning when needed.



ALTERNATING METERING tanks (2) keep a steady flow of oil going to the pipelines. Only two of the existing 500-bbl. tanks (1) are needed. Existing tankage for overflow is 18 tanks (3). Fig. 2.

Monitor operation . . . Fig. 4 is a schematic diagram of the two-tank system. In this scheme, clean or treated oil enters the urge tank directly from the heater treater. The surge tank in the case of the North Burbank Unit consists of two 500-bbl. tanks with an equalizing manifold so that the levels in both tanks are always the same.

As the oil in the surge tank rises and covers low level control, the monitor circulating pump starts and continually circulates surge-tank oil through the b.s. and w. monitor cell. This is a capacitance-type cell which is calibrated in per cent water cut in the oil. If at any time the water in the oil in the bottom of the surge tanks reach a level of 0.5 per cent, then valve V-1 opens and a circulating pump starts and circulates the bad oil of the bottom of the surge tanks back through the treater.



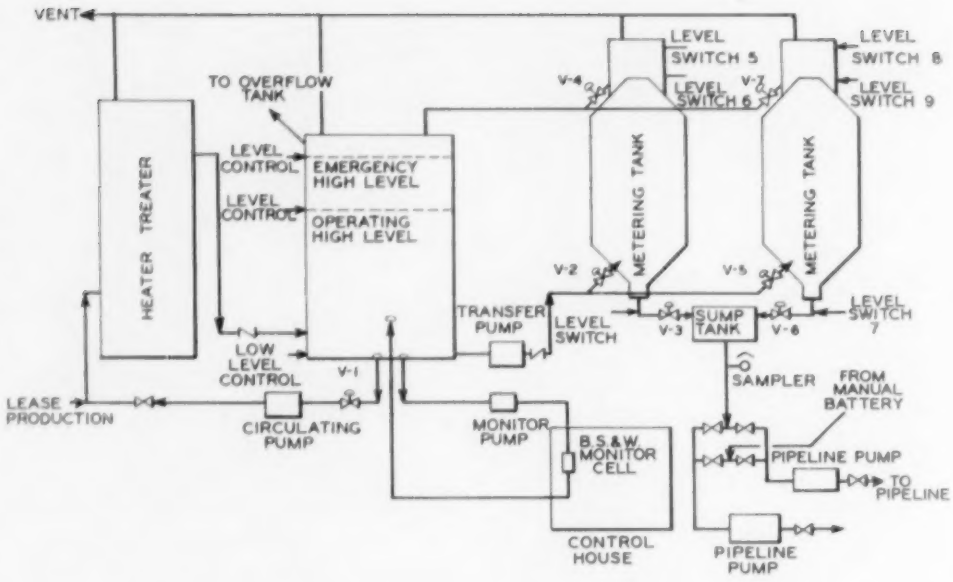
METERING TANK has cone bottom and top. Truncated top cone forms a weir to top out tank. Fluid entering tangentially helps keep walls clean and prevent gas pockets. Draindown is to valve 6. Fig. 3.

This monitor cell overrides all other operations. As long as it detects bad oil the remainder of the system is completely shut down. This insures that only merchantable oil is ever delivered to the measuring vessels.

Once the oil in the surge tanks cleans up and the monitor so indicates, then normal operations can be resumed. If the system does not clean up the surge tank will fill to an emergency high level, the lease will be shut in, and a signal will appear on the office switchboard.

Transfer . . . As long as clean oil is being produced, the monitor will allow normal operation. The surge tank fills to the high operating level which permits starting of the transfer pump. This pump can then run any time it is triggered by meter-tank level switch 6 or 7 or until such time as the surge-tank low-level control actuates.

There are two metering vessels which are interlocked so filling cycle can occur only on one vessel at a time. Now with level switch 4 dry, V-2 is open and the transfer pump starts. The oil enters the metering tank and rises until level switch 5 is actuated. This, in turn, closes V-2, stops the transfer pump and starts a 1-miinute time-delay relay



AUTOMATIC battery holds treated oil in surge tanks where it is checked by monitor. If oil is merchantable an empty metering tank will trigger transfer pump which quickly fills the vessel. It tops out and then dumps to pipeline. Fig. 4.

which will open draindown valve V-4.

When level drains down to actuate level switch, V-3 opens and a pipeline pump starts. As V-3 opens and with level switch 7 dry, V-5 opens and the transfer pump starts. Now the second metering tank starts to fill as the first is being pumped out. The same cycle is repeated on the second tank. The transfer-pump capacity is greater than the pipeline pump so that there will always be a tank ready for delivery. Both pumps, however, have capacities greater than the production rates.

Recording oil . . . Now, how do we get the information we require to sell oil by this system? The basic information required is volume delivered, temperature at delivery time, gravity and b.s. and w. cut. Since the volume of each tank is fixed, we must know the exact number of dumps and then make temperature and b.s. and w. corrections. Gravity is necessary to determine the price schedule and in a limited way is employed in making temperature corrections.

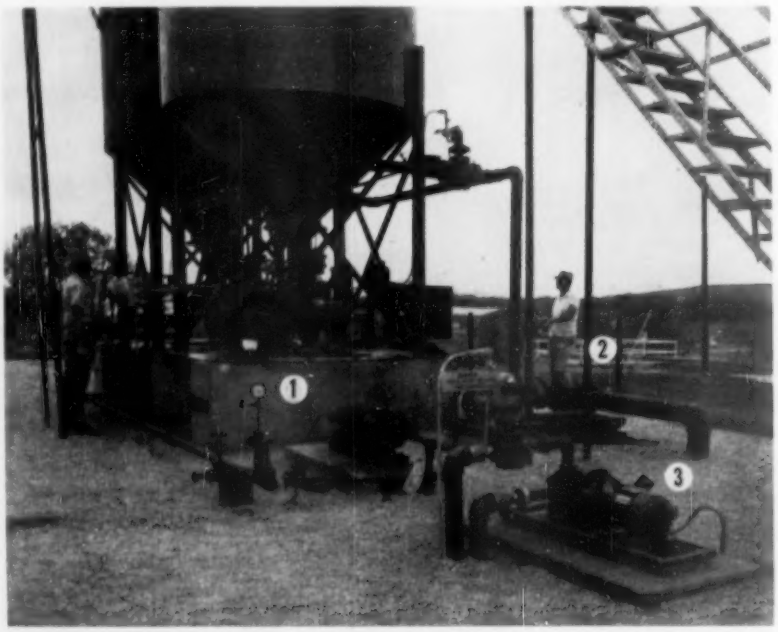
To get the number of dumps from each tank, two magnetic counters are used. These counters are of the type that cock when a dump starts and trip and register dump number when dump is completed. This insures against getting a dump register for anything less than a complete operation. In addition to the counters, two two-pen recorders are used. One pen registers head in the measuring tank and one registers the temperature.

Fig. 6 is a portion of one of these charts. You will note the fill cycle, the topout, and the dump cycle. Following down, the crude-oil temperature when the dump cycle is started is shown. The pipeline representative can see that the tank filled, then topped out to the weir and completely dumped each time. The gravity and b.s. and w. information is obtained from a proportionate composite automatic sample taken as the run is made to the pipeline (Fig. 7).

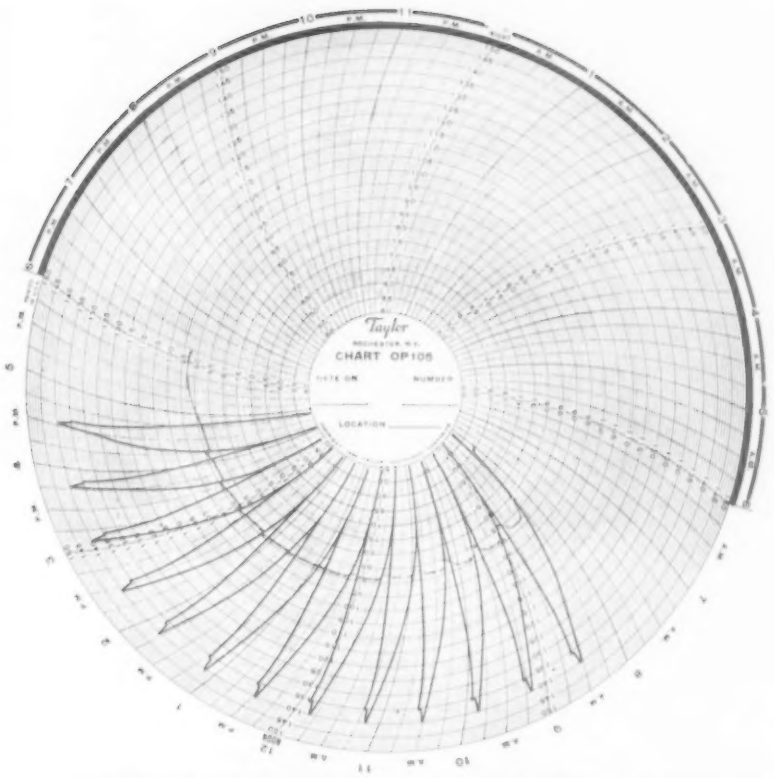
Equipment Performance

In the assembly and shakedown run of our North Burbank Unit, it was found that level-sensing equipment needs careful consideration. In our installation, level-control accuracy is not vital, but reliability is since the entire operation is dependent upon functioning of these devices.

Level control . . . Floats are satisfactory insofar as our accuracy requirements are concerned but due to accumulation and incrustation, they do fail to function at times. Also, floats must be protected from turbulence and direct flow channels. This introduces the possibility of traps for paraffin buildup. This incrustation problem can be mini-



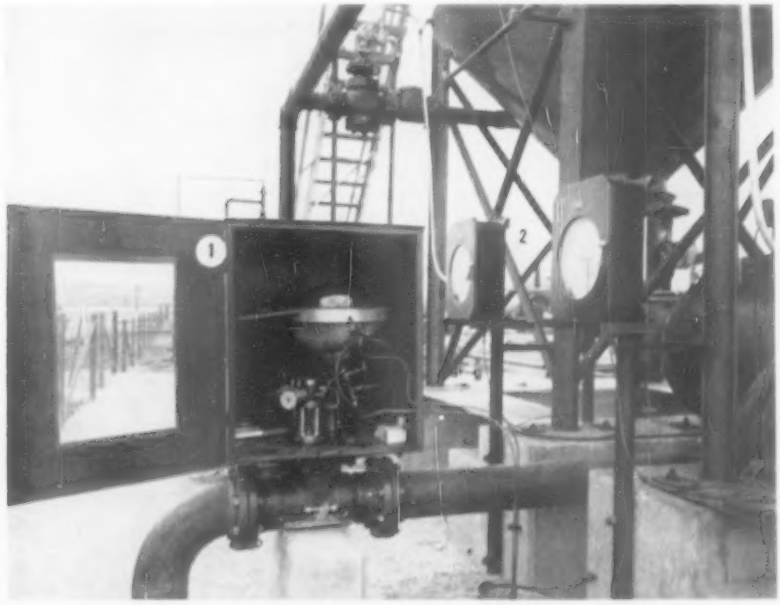
MONITOR PUMP (1) continuously sends surge oil through b.s. and w. monitor. Circulating pump (3) sends bad oil back to transfer and transfer pump (2) sends clean oil to metering tanks when signaled by an empty metering tank. Fig. 5.



DUMPING RECORD shows height to which metering tank fills and records temperature. Each rise and fall indicates one dump. The pip near the peak of the curves shows that the tanks have filled and topped out properly. Fig. 6.

mized by plastic coating but still, floats are not completely satisfactory.

Capacitance type of probes, again, are accurate enough for our needs, but they have shortcomings. The probes are made of Teflon, so there is very little buildup or paraffin accumulations. Capacitance probe devices, however, are subject to drift: they may be temperature sensitive; condensation affects the point at which they trip; and extreme care must be exercised in installation to avoid getting the probe too close to steel walls or too confined by steel. The need for a more foolproof level device is indicated.



AUTOMATIC SAMPLER (1) takes a proportionate composite sample of oil for each dump of a metering tank. Gravity and b.s. and w. are obtained from this sample. Charts (2) record tank level and temperature. Fig. 7.

Valves . . . Commercially available valves are, generally speaking, satisfactory; but it is nevertheless a fact that valving operations would be benefited by a special product specifically designed for this service. For example, certain locations could use a really good three-way, three-position valve. Other essential features of valves for automatic custody operations are positive shutoff, convenient and adjustable limit controls, positive action, controllable operating speed, elimination of sticking, and of course, long life.

Data handling . . . The data-handling instruments must also be considered. Here again we have not been able to obtain exactly what we need. Printout of temperature-corrected cumulative-volume would be very desirable; but at present such a device is too expensive and cannot be justified. In lieu of this, a dump counter, a pressure-head recorder, and a temperature recorder are used.

Here it would be desirable to have a spring-driven, electric-wound, two or three-pen strip chart. The portion of the chart recording temperature should read from 20° to 120° with 1° divisions. The second pen will record pressure head and has no significance from an absolute standpoint, serving only to assure complete filling, proper draindown, and complete emptying. The third pen could be used to record b.s. and w. content.

Over-all . . . When the unit was making its shakedown run the usual number of troubles were encountered. These troubles included leaking joints, leaking valves, incorrect valve timing, electrical connection errors, faulty relays, and interlock mixups; but there was no malfunctioning of the basic principle.

As an example of the trouble encountered, our system employs valve interlocks using limit switches and also employs a fail-safe feature whereby all valves close on a power failure. Now, on power failure, the limit-switch interlocks would prevent resumption of normal operation until the valves were properly timed and some rewiring was performed.

Metering tank . . . Once the bugs of installation were corrected, the unit was operated without interruption. Accuracy checks indicate that the measur-

ing vessels dump exactly the same quantity each and every time; and whenever a discrepancy was found to exist between gaged tanks and the metering tank runs, it was because of misgaging, tank incrustation, bottom buildup, or incorrect strapping. As a matter of fact, the measuring tanks are prover vessels.

The only problem of accuracy was the degree of accuracy that was obtained in calibrating the measuring vessels. When the calibration was performed, there was considerable discussion as to procedure. Obviously, a 100-bbl. vessel cannot be proved with a 10-gal. prover; also, it was thought because of its shape, it could not be strapped.

As a final compromise, an A. O. Smith calibrating positive-displacement meter was purchased. The meter was proved at the beginning of each run and after each run. It might be interesting to note here that the meter-tank volume was computed from the drawings supplied by manufacturer, and that these figures were 94.16 bbl. The meter calibration showed 94.380 bbl. for one tank and 94.615 bbl. for the other tank.

It is concluded that the metering system is accurate, reliable, and is a feasible and economical way of selling oil to the pipelines. The only question remaining is upkeep, and we feel certain that the final analysis of this phase will not change our appraisal of the system.

Results From Operation

Indications are that at North Burbank a gravity increase of from 0.2° to 0.5° will be realized. This is in line with results obtained by other companies which have been experimenting with automatic custody transfer.

In some cases, this gravity increase could represent an increase in the price of oil. In all cases, however, it represents a volume saving. Three-tenths of 1° A.P.I. gravity increase represents approximately .45 per cent volume saving. On 5,000 bbl. per day production handled through this battery, this represents a saving of 22½ bbl. of oil.

Further savings . . . In addition to the reduction of evaporation losses, this method of operation will eliminate tank-bottom losses. Automatic lease custody transfer will, in all instances except for leases producing less than 300 bbl. per day, result in a direct investment savings.

For example, the investment for tankage and piping alone on a 300-bbl. per day lease will represent approximately $10,000, while an automatic lease-custody-transfer installation on the same lease could be installed for approximately $8,000. On a 5,000-bbl. per day battery, such as our North Burbank installation, the tankage and piping for manual operation would cost at least $85,000; an automatic-custody installation at this same battery could be made for $15,000.

Our installation, because of its experimental nature and because of changes and revisions, cost considerably more than this figure, but with experience gained, we now know what costs will be on future installations.

In addition to savings realized by producers, the pipeline companies can realize huge savings in labor, lines, and power installations. When automatic operations become generally used, transportation lines can be utilized with a load factor approaching 100 per cent whereas under the present system, load factors in the vicinity of 50 to 60 per cent are not uncommon. The power pumping installations of the pipeline companies can also be reduced correspondingly.

Improved reliability . . . Basically, automatic-custody-transfer systems have been designed which have accuracy and reliability far in excess of the conventional gaging system. Experimental and actual operations have proved the system beyond any reasonable doubt. The savings to be realized become more apparent with each new development and present a challenge to engineers and management alike.

The keen interest which these factors have stimulated in the minds of management and engineers has resulted in widespread experimental studies and installations by a great many oil companies and, in some cases, by manufacturers. These installations and studies embody many different types of equipment and many different arrangements of components. The diehards in the pipeline industry, as well as in production companies and state regulatory bodies, are reversing their stand and are one by one accepting the principle of automatic custody transfer.

Phillips Petroleum Co., during 1957, will install probably 25 automatic-custody-transfer batteries. Automatic custody transfer is here; it is a reality; and will in itself become a custom of the industry. As more and more installations are made and actual operating experience is gained, there will be inevitably a mass of new developments, new designs, and new techniques. Out of this activity will come cheaper and simpler systems which may eventually develop into standard designs.

Are You Among the Drilling Contractors?

Your Journal editors are . . . so they can keep track of what's going on and pass on the information to you.

Don't overlook "Among the Drilling Contractors' . . . a weekly Journal feature designed to keep you up to date with what other contractors are doing—who is drilling where.

Nelson Refinery Construction Index

Appears in the Engineering Section in the first issue each month.

Compiled by W. L. Nelson, petroleum refinery consultant, Tulsa.

The Index was explained July 7, 1952 (page 105), as well as the Indexes of Individual Items of Equipment that appear on the Cost-imating page in the first issues of the months of January, April, July, and October.

	Index (1946 = 100)					
	1949	1952	1953	1954	1955	July 1956
Pumps compressors, etc.	135.9	155.6	162.5	166.5	172.2	192.4
Electrical machinery	130.9	152.4	156.4	160.0	162.5	173.7
Internal-combustion engines	124.8	146.5	148.1	150.5	153.2	162.7
Instruments	123.1	146.2	151.8	154.6	162.9	181.9
Heat exchangers	133.0	165.8	174.9	171.7	156.8	197.8
Miscellaneous equipment average	*121.6	153.3	158.8	160.7	161.5	181.7
Materials component	143.6	164.3	172.4	174.6	176.1	188.8
Labor component	137.1	163.1	174.2	183.3	189.6	200.0
Nelson construction index	139.7	163.6	173.5	179.8	184.2	195.5

*Used in computing the Nelson Index until April 1952. This is slightly different from the average of the Miscellaneouse Equipment Items shown above.

NORTH TEXAS with its numerous shallow pay zones is one of the most active areas in the country. Most of the drilling is done by independents. Arrowed fields are recent seismic discoveries.

North Texas—Land of Independents

Where can the small independent find oil?

2

by Norman S. Morrisey
Drilling-Development Editor

Here is the second in a series of short articles showing where the small independent can explore for oil successfully and economically in the United States. The article gives the reader the pay zones and their reserves, cost of exploration, what his chances are for finding oil, and what the oil traps are in North Texas.

The first in the series appeared in the August 13 issue of The Oil and Gas Journal, (p. 182) under the title "Northern Oklahoma Offers Opportunity for the Small Operator." The third will cover Kansas and will appear in an early issue.

NORTH TEXAS with its numerous shallow pay zones is a real haven for the small independent operator. In the first 6 months of 1956, operators drilled 2,322 wells. This total was surpassed by only Kansas, Oklahoma, and West Texas (Railroad Commission Districts 7-C and 8).

Production occurs from the grass roots down to about 7,000 ft. except in Grayson County where deep production is found below 10,000 ft. But apart from this area, North Texas exploration is confined to shallow and intermediate depths.

Principal producing zones are the Cisco sands, Canyon sands and limestones, Strawn sands, the Caddo limestone and conglomerate, and the Mississippian limestone. Although most small oil companies stress subsurface geology, seismic work (Table 1) is used with satisfactory results in some areas. One operator who relies on shooting recently drilled 11 seismic prospects. The results? Only two dry holes and nine new oil fields.

In the first 6 months of 1956, the over-all wildcat discovery ratio of 1 in 6 compared favorably with the national average.

Pay Zones of North Texas

Strawn . . . The most sought-after pay is the Strawn. These sands occur over much of North Texas, and in most areas there are usually several Strawn sands developed at drilling depths above 4,500 ft. If one fails to produce, there is always the chance of finding a deeper sand. In addition, the Strawn comes in above the other pay zones and more important, the Strawn sands have higher reserves than the deeper zones. Engineers figure ultimate recoveries in terms of 150 to 200 bbl. per acre-foot of Strawn pay, or reserves of 2,000 to 6,000 bbl. per acre, depending of course on sand thickness and lithology.

Today there is sufficient subsurface control in most areas of North Texas to find Strawn prospects. Much of the Strawn production is related to stratigraphy rather than structure. The Strawn sand pinches out updip and production is found where the sand is draped over a structural nose or on the flanks of anticlines. A closed structure with sands covering the entire closure seldom, if ever, produces oil from the Strawn sand.

Table 2—Estimated Ultimate Recoveries From Selected North Texas Caddo Oil Fields

	Discovered	Present No. Oil Wells	Depth (ft.)	1955 Prod. (bbl.)	Accum. Prod. (bbl.)	Est. Ult. Recovery (bbl.)	Est. Ult. Recovery (bbl./acre)
ARCHER COUNTY:							
Duke	1953	1	5,562	6,767	27,734	62,000	1,500
Hull-Sikes	1940	3	4,600	2,592	500,536	515,000	3,300
Scotland	1940	3	5,050	5,215	800,421	830,000	
BAYLOR COUNTY:							
Parkey	1952	6	4,935	16,165	146,877	226,000	1,000
Seymour	1950	6	5,087	7,918	196,027	236,000	1,000
CLAY COUNTY:							
Gowan	1953	3	6,037	43,022	129,016	340,000	3,000
Hopgood	1940	6	6,086	32,228	555,654	700,000	3,000
Lazy "B"	1949	8	5,175	53,790	955,784	1,210,000	4,000
FOARD COUNTY:							
Canal Creek	1951	3	6,172	40,988	179,439	380,000	3,200
Jack County							
Bryson, South	1950	3	4,040	8,193	165,278	205,000	2,000
Peek	1943	8	4,582	29,087	626,511	775,000	2,500
Risch, East	1953	18	4,412	175,229	299,422	1,000,000	2,500
Winn	1953	2	4,871	22,532	93,820	200,000	
MONTAGUE COUNTY:							
Aries	1953	31	6,113	359,058	523,331	2,500,000	2,000
Kennedy	1948	6	6,180	13,682	878,795	953,000	4,000
Lewis-Stewart	1947	22	6,215	42,059	2,704,990	3,000,000	3,500
Richardson-Mueller	1943	61	6,112	286,934	2,465,718	4,000,000	1,750
WILBARGER COUNTY:							
National	1946	4	4,978	6,479	270,846	310,000	2,000
WISE COUNTY:							
Miles-Jackson	1954	5	5,983	9,724	15,798	65,000	
Peel	1951	10	3,792	9,828	292,809	342,000	1,000
YOUNG COUNTY:							
Allar	1943	4	3,553	19,436	161,139	230,000	1,500
Sewell	1940	5	4,011	5,900	144,591	174,000	1,000
Sweeney	1951	4	3,763	8,883	20,078	60,000	
Warren	1948	8	3,642	32,753	283,957	443,000	1,250

Some operators use geophysical work to check a Strawn prospect. The problem usually is to determine if a location can be staked that is higher than a dry hole with good shows of oil in a Strawn sand. This approach is quite reliable for determining the structure, but cannot forecast sand conditions. However, it has been found that Strawn sand deposition is often related to certain structural patterns as indicated by seismic studies. This is particularly true in Clay and northern Archer counties.

Caddo production . . . In North Texas, "Caddo lime" is no specific stratigraphic unit. It can best be described as the first Pennsylvanian lime below the Strawn, or the first Bend lime. Due to local truncation and depositional variations, the Caddo can occupy a rather wide stratigraphic range.

In early regional work in North Texas when subsurface data consisted largely of drillers' logs, the Bend section was easily recognized by its dark shales and limes. The first Bend lime took on the name Caddo and was widely used as a regional marker. In later years, electric logs and sample logs, as well as a greater density of drilling, pointed out the variety of Caddo limestones. Local variations can often be found in seismic studies, but the danger still exists.

Geophysical work is quite successful in mapping Caddo prospects. Most of these are based on subsurface control or previous shooting. For this reason, seismic work will confirm a high percentage—one-third or even one-half—of the leads investigated. And geophysicists claim that as many as one-half of the seismic leads drilled in some areas have produced. Inadequate reservoir conditions often help to make up the majority of the failures rather than a geophysical "bust."

Lack of reserves is the big deterrent to Caddo exploration (Table 2). Notoriously, the reservoir has low reserves.

TABLE 1—TYPICAL RECENT MISSISSIPPIAN SEISMIC DISCOVERIES

Company	Field	Location
Panhandle Oil Corp.	Donnell	Stephens County, Texas
L. T. Burns Estate	Grady Vaughn	Clay County, Texas
L. T. Burns Estate	South	Clay County, Texas
L. T. Burns Estate	Burns-Brown-Mississippian	Clay County, Texas
L. T. Burns Estate	Cowan & McKinney "E"	Archer County, Texas
L. T. Burns Estate	Prideaux "B"	Archer County, Texas
L. T. Burns Estate	Elsie P. Smith	Archer County, Texas
Panhandle-LaGorce	Lapan	Clay County, Texas
Sunray Mid-Continent	New Castle-Mississippian	Young County, Texas

Table 3—Estimated Ultimate Recoveries From North Texas Mississippian Oil Fields

	Dis-covered	Present No. Oil Wells	Depth ft.	1955 Prod. (bbl.)	Accum. Prod. (bbl.)	Est. Ult. Recovery (bbl.)	Est. Ult. Recovery (bbl./acre)
Anarene (Archer)	1950	2	5,207	3,076	63,435	91,000	1,250
Conner (Archer)	1951	3	5,150	17,992	186,903	266,000	2,250
McAnally (Archer)	1951		5,387		44,398	44,398	
Olney Bank (Archer)	1951		5,249		12,461	12,461	
Scotland (Archer)	1941	2	5,145	2,136	323,520	334,000	
Weston	1950	1	5,058	3,703	51,007	70,000	1,750
Rendham (Baylor)	1953	3	5,429	56,700	159,719	300,000	2,500
Ambassador (Clay)	1950	10	5,954	29,799	399,896	550,000	1,250
Antelope (Clay)	1941	58	5,670	18,500	374,470	464,000	
New York City (Clay)	1952		6,275		823,873	823,873	
Winn (Clay)	1943		6,454		467,888	467,888	
Alco (Jack)	1951	2	4,295	10,424	159,801	210,000	1,750
Bryson (Jack)	1947	3	5,158	5,311	314,408	340,000	2,120
Bryson, South (Jack)	1953	7	4,972	73,922	193,895	550,000	2,000
Upham (Jack)	1950	2	4,800	2,175	52,807	63,000	815
Burns-Ragland (Young)	1943	4	5,000	19,182	472,755	557,000	2,300
Cy Perkins (Young)	1952	1	5,200	13,482	48,819	112,000	1,420
Gretchen (Young)	1952	2	4,708	11,830	60,718	115,000	1,450
Minta Wright (Young)	1949	3	4,525	10,644	81,814	112,000	1,000
Nash-Daniel (Young)	1951	4	4,391	20,725	104,471	210,000	1,300
Padgitt (Young)	1942	1	4,800	3,291	478,270	494,000	
Ryan Oil (Young)	1950	1	4,763	6,651	44,491	75,000	1,000
South Bend, West (Young)	1951	2	4,390	81,277	251,794	650,000	

Few Caddo fields have ultimate recoveries that will exceed 4,000 bbl. per acre. And there are many Caddo pools with reserves of less than 1,500 bbl. per acre.

The redeeming features to Caddo exploration are the 40-acre well spacing and the fact that many of the Caddo fields have more than one pay zone . . . either from overlying Strawn sands or the underlying or nearby Mississippian. These factors combine to make Caddo exploration a paying proposition under favorable conditions.

Mississippian . . . Although there is deeper production in North Texas, the Mississippian is the deepest target over much of the area. Reserves in the Mississippian are similar to those in the Caddo and these are figured in terms of 50 to 100 bbl. per acre-foot of pay or 1,000-2,000 bbl. per acre (Table 3).

The small sharp Mississippian lime highs do not always underlie the Caddo highs. In fact, the exceptionally good Mississippian features may show no favorable Caddo structure immediately above the Mississippian high but may show generally high Caddo surrounding the Mississippian high. This may be due to minor pre-Strawn erosion of the uppermost portion of the Bend, leaving remnants of rim scarps of Caddo lime surrounding the Mississippian high.

Inasmuch as the better Mississippian fields are the result of strictly local features—reef type of limestone growth—Mississippian "leads" are hard to find from subsurface studies.

Where the Bend is predominantly limestone, and where no great sedimentary contrast exists at the top of the Mississippian lime, it is not unusual to miss minor sharp Mississippian highs with seismic studies. However, Mississippian leads can be mapped under favorable conditions with the seismograph, but more often than not the producing area is small. Or, as one oil finder put it, "When you find Mississippian production, just drill the discovery well and quit." A study of these oil fields supports this observation because there are only a handful of Mississippian pools with over five wells.

Cost of shooting two adjacent 320-acre tracts (640 acres) is about $4,800 or $7.50 per acre. A close grid shooting program is used in the beginning and, if a structure is found, additional points are shot to locate the highest point on the structure.

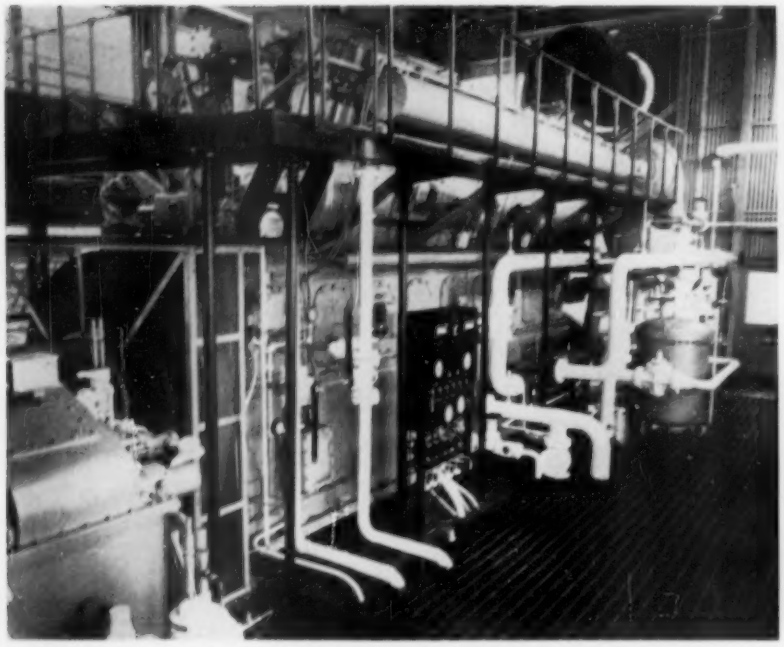
It is difficult to estimate the amount of oil contained in each Mississippian reservoir because much of the Mississippian limestone contains vertical fractures. Each separate "reef" mass has its own oil-water contact that has no bearing on nearby "reefs."

Outlook . . . Prospects for finding new oil in North Texas are good. The old reliable reservoirs are by no means exhausted. But the area's real oil potential may lie in reservoirs not normally considered in today's exploration. The Ellenburger, although oil-bearing, is not a primary objective. And below the Ellenburger is the Cambrian.

Along the northern part of Wilbarger, Wichita, and Clay counties there are ample opportunities to find wedge belts of porosities and stratigraphic traps in the pre-Permian carbonate rocks where oil can accumulate below the Permian unconformity. It is this type of production that offers a real future to the North Texas oil finder. Geologists are actively seeking this type of production in Oklahoma, Kansas, and in many other parts of the country.

Geological conditions are favorable for stratigraphic accumulation in carbonate rocks in North Texas. It may be only a question of time until this type of strat trap dominates the exploration thinking in North Texas.

"Area's real potential may lie in reservoirs not normally considered . . ."



FOUR-CYCLE ENGINE which drives Gulf Interstate's centrifugal compressor at the remote-controlled Stanton, Ky., station. Board at side of engine is for manual control.

CONTROL BOARD for automatic control and telemetering.

Gas-Compressor Station Goes Automatic

Here's how equipment was selected and some of the problems of remote-controlled, engine-driven centrifugal station

by R. Lochiano

THE Stanton, Ky., remote-controlled station of Gulf Interstate Gas Co. has proved successful in operation. There have been no false shutdowns since March 1956, when the unit was put on the line.

The automatic station is definitely in the future of our company and of the whole gas industry. We have started the design of future stations, patterned after the Stanton unit.

Future stations will no doubt be designed for even more automatic operation. One of the possibilities is to let the station controls handle the starting and stopping of engines, based on the requirements to satisfy certain flow conditions.

Main-line station . . . The Stanton station is on the company's main line. It has a four-cycle, turbocharged engine driving a centrifugal compressor through a gear increaser. The station is controlled automatically by a controller which maintains a constant discharge pressure by varying the speed of the engine.

The station is completely unmanned except for a maintenance mechanic who is on duty 40 hours a week. The operation is performed remotely from the next compressor station located some 90 miles away, which we term the master station.

The operator at the master station has the ability to change the set point on the discharge pressure controller and to start or stop the engine.

Why this equipment? . . . It might be of interest to discuss our thinking at Gulf Interstate both as to the reasons this particular combination of equipment was selected and as to what we were trying to accomplish in the design of the automatic equipment.

Of course, actually there is nothing new about any of the components. The four-cycle engine and the centrifugal compressor are both in common usage; it is only their combination, then, as specifically applied to the gas industry, that is untried.

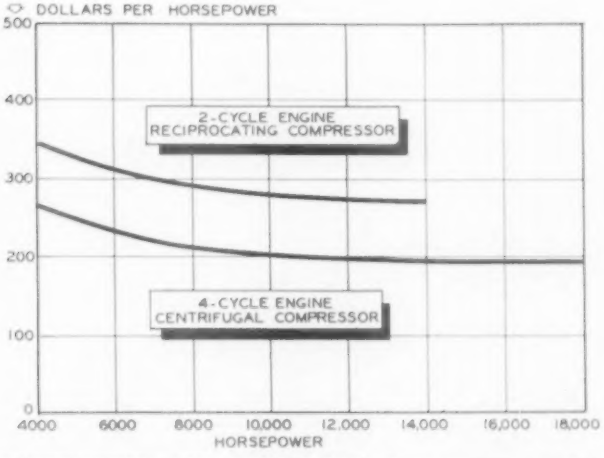
The reason the particular engine-centrifugal compressor combination was selected was that in our opinion it affords the most economical station for Gulf Interstate's type of operation.

Selection of Equipment

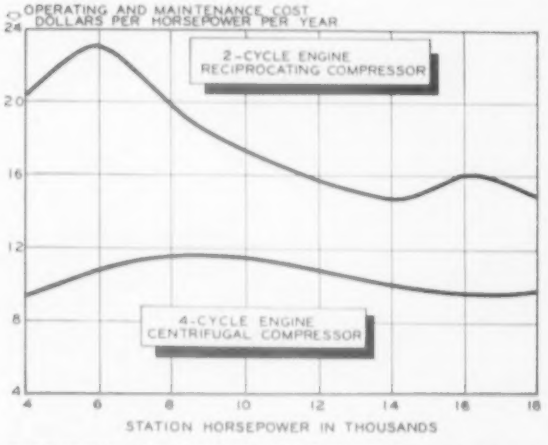
Thinking in terms of our future station construction, we wanted to build something that would be a step forward and an improvement over our present stations. There are four components to be considered in the over-all economy of a compressor station. They are operation, maintenance, fuel, and installation costs.

To reduce operating costs requires

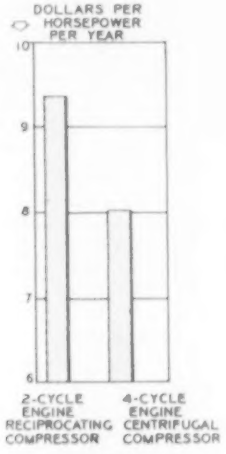
Author is with Gulf Interstate Gas Co., Houston. Paper presented at 1956 A.S.M.E. Petroleum Mechanical Conference, Dallas.



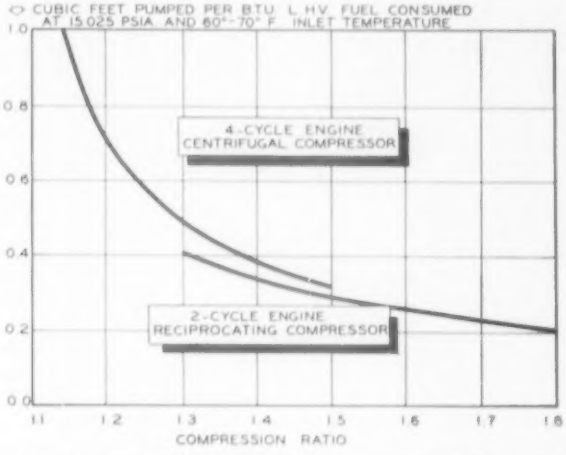
CONSTRUCTION COST COMPARISON of gas-compressor stations. **Fig. 1.**



OPERATING AND MAINTENANCE COSTS for gas-compressor stations. Fig. 2.



FUEL-GAS COSTS for reciprocating and centrifugal compressors. Fig. 3.



OVER-ALL STATION EFFICIENCIES for centrifugal and reciprocating compressors. Fig. 4.

a reduction of manpower. Since our existing stations are what we call "semi-automatic" and have only one operator to a shift, it requires a completely automatic station without any operating personnel to better it any.

A study was made of our existing stations to determine what work the operator actually performed. It was decided that the one item which took most of his time was the reciprocating compressors. They required periodical replacement of broken valves and adjustments of compressor pockets. While both of these items could be overcome perhaps to fit an automatic station, it was felt that the best approach would be to eliminate the problems if possible.

This pointed to the usage of a centrifugal compressor. The centrifugal compressor also satisfied in part the economical approach which was being pursued because of its lower maintenance cost and higher efficiency at low ratios than a reciprocating compressor.

If a centrifugal compressor was to be used, a prime mover for it had to be economical or it would offset the advantages of the compressor. Electric power was not available at a low enough rate to be considered, so only gas-fired engines were compared. Among these the turbocharged, four-cycle engine offered the best fuel economy by a fairly wide margin.

The four-cycle engine also had the ability to operate efficiently at varying speeds which was desirable to provide flexibility in operating the station. Generally speaking the larger the horsepower of a unit, the cheaper it is to install on a per horsepower basis. This large horsepower unit also was desirable for the requirements of the compressor whose size is determined more by the flow going through it than the horsepower required.

Because of the large flows involved, the horsepower input could be quite large without increasing the size of the compressor. With these reasons as a basis, it was decided to build an automatic centrifugal-compressor station driven by a high-horsepower, turbocharged four-cycle engine through a gear-speed increaser.

Figs. 1, 2, 3, and 4 show the comparison of costs and efficiencies between a two-cycle engine-driven reciprocating compressor and a four-cycle engine-driven centrifugal compressor. Both the two-cycle and four-cycle engine-driven compressors are installed on Gulf Interstate's main line. The two engines are the latest design and offer the most efficient fuel consumption available today.

Design Problems

There are four general points of comparison on which a new design has to be equal to or better than an existing design, before it can be justified. These points are: (1) safety, (2) de-

pendability, (3) accuracy or reliability, (4) simplicity and low cost.

Safety . . . In the matter of safety, our intention was not to just make the station as safe as an attended one, but to make it safer.

To insure safety, every phase of its operation was studied to determine what could go wrong that would be dangerous and some method was worked out to give a protection by shutting down the engine, sounding alarms, turning on fire-fighting equipment, opening blowdown valve, and so on.

All equipment is "fail safe" in that loss of power or equipment breakdown will give the alarm or shutdown required.

To reduce the possibility of fire, high-pressure gas was not brought into the buildings, even in gage lines.

Fire detection . . . Particular attention was paid to fire detection, with three systems being used. One system sees the fire and is extremely sensitive but is subject to false alarms. The second is actuated by the rate of temperature change and is less sensitive than the number one but is not subject to false alarms. The third is actuated by high temperature and is least sensitive but most reliable.

The first system sounds an alarm which should bring investigating personnel. A pipeline operation office is headquartered at the station site and two company houses are located on the property, so that there is someone available to answer the alarm 24 hours a day.

The second two systems back up the first one, and shut down the engine, close the station side valves, blow the yard gas piping down (which includes all fuel gas lines) and then after allowing time for the lines to be depressured, turns on the CO_2 gas system which floods the area where the fire was detected in the buildings. The lines are depressured before turning on the CO_2 system.

In order to anticipate the condition which might start a fire, a continuous gas snifter samples the atmosphere from around potential danger areas.

The gas compressor is not only placed on the other side of a firewall, but is actually placed out of doors so as to minimize the possibility of a buildup in concentration of gas.

The sequencing for the automatic starting of the engine and putting the compressor on the line is such that should any event fail to occur the sequencing will stop and have to be initiated again.

The sensing devices for an action taking place, are on the results of the action and not the action itself. For instance on the main-fuel gas valve, gas pressure downstream of the valve is detected, to determine whether the valve opened rather than some limit switch on the valve itself.

One of the most unreliable features in connection with a remote-controlled station is the communication lines that tie the master station to the slave station. This line has periodic interruptions, which could be serious if the station's operation is dependent on its continuity. The proper design then is to have all controls at the station independent of the communication line except for changing conditions that are to be maintained, such as discharge pressure, engine running or engine down.

As loss of electric power would shut the engines down, because of the fail-safe system used on the controls, it is of utmost importance for us to maintain a source of power. Upon failure of the REA power a small generator unit automatically comes on to pick up the electric load. Should the emergency generator unit fail to come on the line, power is sustained by batteries.

To further promote the dependability of the station, the engine is made self-sufficient by requiring that all of the auxiliary equipment for the normal running of the engine be driven by the engine itself. This includes the fan drive, jacket-water pump, engine lube-oil pump, lube-oil-cooling-water pump, seal-oil pump, and gear-oil pump. All of the equipment is unitized so that one unit is not dependent on another for any of its functions.

Reliability . . . Accuracy is important in any control system in order to achieve reliability. On the items that were important, such as the discharge-pressure controller, we used electronic instrumentation.

As all instruments have accuracy that is a per cent of their full scale, the scales selected were evaluated carefully to determine the minimum range that could be tolerated.

To minimize distortion or accuracy, all telemetered quantities are put into a digital code as soon as possible and are transmitted and displayed in lights in that form at the "master" station.

Simplicity and Low Costs

Low cost in controls can be a stumbling block if not considered in the proper light. Low cost in controls should not be achieved by sacrificing quality but by eliminating unnecessary functions and keeping the system as simple as possible. We attempted to follow this rule by telemetering to the master station only the information that would be usable to operator at that end.

For instance, we do not telemeter the position of loading valves, but merely that the compressor is on the line, which is not telemetered until the valves are all in their proper position. The 52 safety devices on the engine are all grouped into three classifications—alarm, shutdown restart, and shutdown lockout. These three pieces of information are the only ones that are telemetered.

The alarm items are ones that need attention but no damage can result from them, in their present condition. Under this classification would be such items as oil level low, surge-tank level low, etc. If no one attended to the low oil level, eventually it would all be gone, then the low oil pressure would shut the engine down before the engine would be damaged.

The shutdown-restart group covers items that are serious enough to shut the engine down, but not serious enough to preclude a restart to ascertain whether the condition has cleared itself or not. Most of the items in this group are high or low pressure or temperature.

The shutdown-lockout functions are those that would be dangerous to try and restart the engine. A broken pipeline or vibration of equipment, which could indicate a broken part, all fall into this category.

Circuit costs . . . To keep the communication circuit costs at a minimum the information is brought into the "master" station sequentially; that is, all the information comes over the same line. In order to bring in an important bit of information without delay, all of the items are given orders of preference.

To make use of a single line, and yet to keep the operator informed of the current condition of the station, indicated quantities such as engine r.p.m. and gas pressures are brought in only when a change beyond a prescribed magnitude occurs. With steady operating conditions, very few changes occur in an hour, yet the operator has the latest information that is of any significance to him.

We make use of a digital telemetered code for accuracy but this same type of code will allow the use of the lowest grade and hence lowest-cost telephone circuit which is the 0-15 c.p.s. system. This cost can become appreciable if the signal is sent very far as the rate is on a straight per mile basis.

To keep the cost low, all electric equipment and controls are placed outside of the hazardous area to get away from explosionproof housing. This also affords a safer system by removing a potential source of ignition of the gas.

Learn about oil-finding from . . .

PROFITABLE GEOPHYSICAL CASE HISTORIES

by Norman S. Morrisey

JOE is nobody's fool. Occasionally he goes overboard and invests in some worthless uranium stock, but when he sticks to oil exploration he does very well. Of course he drills dry holes, but he doesn't drill more than his share. In fact his batting average has bordered on the .300 mark for wildcats for the last 8 years, or nearly one discovery for every three wildcats drilled. "*And two out of every three of the discoveries are commercial,*" Joe pointed out, "giving me an overall batting average of .211 or one out of five. I'll never make baseball's Hall of Fame with that record, but my stockholders are satisfied."

Joe operates in nearly every important oil province in the United States. He's had a lot of experience in oil finding, and always has several contract seismograph crews on his payroll. Since he was in a talkative mood, we asked him, "Why do you put so much reliance in geophysics?"

Surprisingly enough his answer was, "I don't put very much faith in geophysics by itself, but when you combine geophysics with geology, you have an unbeatable combination. I've tried both ways in exploring," he continued, "and each has its merits."

"As a matter of fact, I kept the records over a 5-year period on my prospects, separating the nongeophysical prospects from the geophysical prospects. Oddly enough, my batting average on both ran about .333, but here's the big difference: *Invariably the geophysical prospects gave me a higher return on my investment.* Because of the multiple pay zones, structural traps or combined structural and stratigraphic traps invariably contain higher reserves per acre than the simple strat trap where the target is only one sand."

"But don't take my word for the value of geophysics," Joe said. "Read this new S.E.G. book on *Geophysical Case Histories* and see for yourself what sort of oil fields shooting will find for you." And with that he presented The Oil and Gas Journal with a copy of "Geophysical Case Histories," Volume 2, published by the Society of Exploration Geophysicists.

We read the book and jotted down some notes on the different types of traps that geophysics will find . . . strat traps, complex folds, fault production, salt domes. In short, geophysics has been successful in mapping nearly every type of oil trap known.

Read these notes on the next 11 pages and see for yourself how important and profitable geophysics can be in exploration work, and see how you rate as an oil finder by answering the 60 questions.

". . . geophysics and geology, an unbeatable combination"

Test your oil-finding ability

PROFITABLE GEOPHYSICAL CASE HISTORIES

GEOPHYSICAL PROSPECT	EXPLORATION HISTORY AND MAPPING METHODS

ELK CITY

The lead

Confirmation

This part of western Oklahoma had had few deep tests prior to the discovery of Elk City. One deep test had been drilled on the southeast plunging end of the anticline. Sands in this particular well, however, were not as well developed as on the crest of the structure.

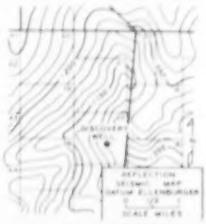
Gravity work showed an area of interest. Leases were purchased on the strength of this information. A seismograph crew was sent into the area to check the prospect.

Field methods . . . The lead was mapped using "leap-frog" continuous profiling. Multiple geophones and mixing helped improve record quality. It was impossible to map a continuous reflecting horizon over the prospect, so phantom horizons were used for map datums. Particular attention was paid to mapping deep horizons since it was believed that the main pay zones would be pre-Pennsylvanian beds. These

ELKHORN

Refraction, 1950

Reflection, 1952



Surface geologists as early as 1925 had mapped a positive trend in north-central Crockett County, West Texas. This work led to the discovery of Todd Deep Pool and subsequently to the seismic survey that uncovered Elkhorn.

Experimental reflection seismic work in the Elkhorn area in 1949 was very discouraging. The method was discarded in favor of refraction shooting. Although the quality of the refraction survey was only fair to poor, the survey mapped a promising lead.

This lead resembled the Todd Deep Field that lay 7 miles to the southwest. One of the refraction lines over the Elkhorn structure failed to map the anticline; however, this is understandable in view of the sharpness of the lead and the steep dips on the east flank. Refraction work is not accurate enough to map the details, but will give a reasonably accurate over all picture.

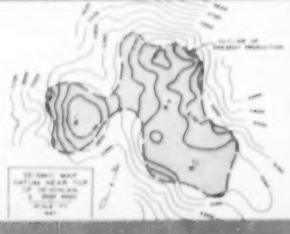
The refraction survey led to the drilling of the discovery well with production from the Ellenburger limestone.

Twelve-channel refraction instruments were used. Geo-

BLOCK 12

Gravity, 1945

Seismic, 1947



Geological studies in the early 1920's outlined a positive trend in the Block 12 area of Andrews County, Texas. The lead lay in the northern part of the Central basin platform. A torsion balance survey tended to confirm the geological interpretation.

The first seismic survey, made in 1937, mapped an anticlinal trend at Yates level. Acreage was purchased on this lead. Additional seismic work was done in 1941 and 1942, and the first test staked. The well proved to be disappointing, an Ellenburger dry hole.

In 1945, a detailed gravity survey outlined an anomaly that coincided rather closely with the seismic lead. The first successful production was from the Clear Fork in Block 12 in 1946 (Well A on maps). A seismic crew re-entered the Block 12 area to obtain additional control in 1946. The primary

DRILLING RESULTS AND OIL RESERVES

targets were expected below 8,000 ft. subsea. The lone deep test on the southeast end of the lead was tied to the survey.

North-south sections clearly define the structure since they are oriented almost at right angles to the structural axis. These sections show at least 500 ft. of reversal.

The seismic survey mapped a large elongate anticline. And on the basis of this survey, the discovery well, Shell Oil Co. 1 Walters, was staked.

DRILLING RESULTS . . . Elk City is a major oil field with an ultimate production estimated at 120 million barrels of condensate in addition to the gas production. Today the field has 306 oil wells.

Development drilling confirmed the seismic work and shows the structure to be an elongate anticline. The producing area is 8½ miles long and 2½ miles wide. And the field has 400 ft. of producing closure. The pay zones are porous

phone spreads were 3,500 ft. in length with a geophone interval of 350 ft. Shooting distances for the continuous inline profiling ranged from 21,000 - 45,500 ft. An arc line was shot with a radius of 39,443 ft. Shot-hole depths were as great as 510 ft. to penetrate the surface limestone. Average charge size for the inline profiling was 200 lbs. For the arc-line shooting, the average charge was 1,000 lbs. per shot.

DRILLING RESULTS . . . The discovery well found production in the Ellenburger at a subsea datum of minus 4251 ft. The field was developed rapidly. Subsurface control showed a marked similarity between Elkhorn and large Ellenburger field in the general area, Todd Deep. Although the field was defined by faulting on the east flank, there was a strong possibility that open acreage to the north might prove to be productive.

Advances in field techniques and instrumentation made it possible to map the north end of the structure with a reflection survey in 1952. Although the reflection quality was only fair, the anticline is clearly apparent on the east-west cross-sections.

objective was to map a horizon at or near the Ellenburger. The deepest consistent event, however, was a reflection of poor to fair quality identified as Simpson.

Devonian production was established in early 1947, although today there is only the one Devonian producer in the field (Well B). Finally, in 1952, Phillips Petroleum Co. completed the Ellenburger discovery well (Well C on maps). And in 1953, the Block 12 Ellenburger-east discovery was completed (Well D on maps).

DRILLING RESULTS . . . Block 12-Ellenburger has 13 producing wells and the pool has some 200 ft. of producing closure. Block 12-east has about the same amount of relief, but covers a much larger area. Ultimate production from the two fields will exceed 30 million barrels of oil. In addition to the Ellnburger production, there are 36 Clear Fork wells and the lone Devonian producer.

Test your oil-finding ability

TRUE FALSE

☐ ☐ 1. Gravity surveys are excellent guides for oil finding in unexplored areas.

☐ ☐ 2. In new areas, one test will normally give ample information on possible pay zones.

☐ ☐ 3. Setting up a reconnaissance seismic program requires very little thought or planning.

☐ ☐ 4. It is a waste of time and money to tie seismic surveys to wells.

☐ ☐ 5. Depth to pay zones should determine what seismic maps are needed.

☐ ☐ 1. If seismic methods fail, oil finder should concentrate his efforts on more fertile areas.

☐ ☐ 2. Geophysical work is useful during the development phase of an oil field.

☐ ☐ 3. Refraction surveys give a detailed picture of the subsurface.

☐ ☐ 4. All geophysical data should be used in making an interpretation.

☐ ☐ 5. It is sometimes wise to compare geophysical prospects with known oil field structures in the same general area.

☐ ☐ 1. It is unusual for the different types of geological and geophysical surveys to be in agreement.

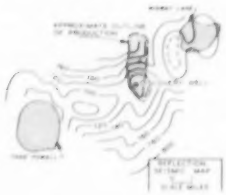
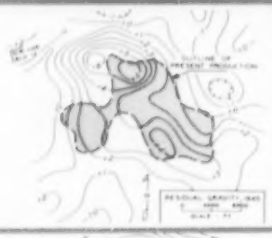
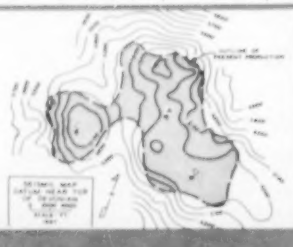
☐ ☐ 2. Maps on shallow seismic horizons sometimes give an indication of a deeper lead.

☐ ☐ 3. Seismic surveys can map truncated wedge-edges.

☐ ☐ 4. One seismic survey will usually give all the information needed in a new area.

☐ ☐ 5. Today, surface geology has very little value in oil exploration.

PROFITABLE GEOPHYSICAL CASE HISTORIES

GEOPHYSICAL PROSPECT		SIGNIFICANCE
ELK CITY	The lead	sections of Pennsylvanian granite wash found between 9,000 and 10,000 ft. Fortunately, these zones were better developed and more porous than in the original dry hole at the southeast end of the lead. SIGNIFICANCE . . . Elk City is typical of the structures that can be expected in unexplored territory. The obvious structures are found first and drilled. Many of them, like Elk City, develop into major oil fields. These large oil fields are the reward for being there first in oil exploration. And being there first does not always mean first in terms of time into the province. First with a new idea also means new oil fields, even in an old established oil province. Elk City reemphasizes the value of gravity work in oil finding, and the wisdom of drilling more than one test on a valid seismic lead before condemning it.
	Confirmation	
ELKHORN	Refraction, 1950 	Subsequent drilling confirmed the successful reflection survey. The field continued to the north. SIGNIFICANCE . . . Elkhorn was discovered in an area where seismic methods were considered inadequate for defining structure. The application of an old technique succeeded where the conventional reflection survey had fallen down. But improvements in reflection techniques only 3 years later permitted the operator to map the structure accurately. Careful analysis of the refraction data and a knowledge of the local geology permitted the interpreters to recognize the questionable and unreliable data. Today, Elkhorn has 51 Ellenburger wells with a proved acreage that covers more than 3 square miles. Ultimate production from the pool will exceed 20 million barrels. The discovery at Elkhorn shows that even today refraction work has a place in exploration. It was designed primarily for mapping shallow salt domes and the method had its heyday in the late 20's and early 30's. Today it is used in complex areas like the mountain front in the Rocky Mountains and in Canada, and in hard-to-shoot areas of West Texas.
	Reflection, 1952	
BLOCK 12	Gravity, 1945 	Drilling has confirmed the seismic and gravity work. Seismic data indicated that the Devonian was truncated in the southeastern part of Block 12. Subsurface wells show that the Woodford and part of the Devonian are missing by erosion in this part of the field. SIGNIFICANCE . . . Perseverance is just as valuable an asset in oil exploration as controlled imagination. Block 12 was first pinpointed in the early 1920's, but over 20 years elapsed before oil was discovered. Reading between the lines, geologists discover that the seismic work has mapped the unconformity that separates the Permian from the underlying Devonian. Certainly this type of mapping could be converted into profitable oil finding in areas where the truncated Devonian produces oil.
	Seismic, 1947 	

THE ANSWERS

1.—TRUE. In many areas, gravity surveys will provide leads that later prove to be oil fields. In addition, gravity and magnetometer surveys combine to give a reliable picture of the regional geology in wildcat country.

2.—FALSE. The first dry hole in the Elk City area might have served to condemn the granite-wash section. Lithology can vary rapidly in short distances and the first test on a prospect may not penetrate pay zones present on the flanks.

3.—FALSE. Setting up any seismic program requires an intimate knowledge of both local and regional geology.

4.—FALSE. The best way to insure the success of a seismic program is to tie the survey to all wells on the prospect. By so doing, you can help eliminate velocity errors.

5.—TRUE. Depth to pay zones and a knowledge of the local and regional geology will determine what mapping horizons give a true structural picture.

Test your oil-finding ability

TRUE FALSE

☐ ☐ 1. Gravity surveys are excellent guides for oil finding in unexplored areas.

☐ ☐ 2. In new areas, one test will normally give ample information on possible pay zones.

☐ ☐ 3. Setting up a reconnaissance seismic program requires very little thought or planning.

☐ ☐ 4. It is a waste of time and money to tie seismic surveys to wells.

☐ ☐ 5. Depth to pay zones should determine what seismic maps are needed.

1.—FALSE. It may be that some other type of geophysical survey will map the area. Better instruments and field techniques today are steadily eliminating these hard-to-shoot areas.

2.—TRUE. A few days shooting is cheap insurance when gambling on a well that may cost $100,000.

3.—FALSE. The refraction survey will give the gross characteristics of the structure. However, it will not map the details.

4.—FALSE. All geophysical data should be considered, but sometimes it is permissible to discount data that appears inaccurate or invalid.

5.—TRUE. Within a given oil province, oil-producing structures often are similar. And a comparison helps to evaluate the new lead in terms of known oil fields.

☐ ☐ 1. If seismic methods fail, oil finder should concentrate his efforts on more fertile areas.

☐ ☐ 2. Geophysical work is useful during the development phase of an oil field.

☐ ☐ 3. Refraction surveys give a detailed picture of the subsurface.

☐ ☐ 4. All geophysical data should be used in making an interpretation.

☐ ☐ 5. It is sometimes wise to compare geophysical prospects with known oil field structures in the same general area.

1.—FALSE. In many areas the different types of surveys will support each other and serve to confirm the basic idea.

2.—TRUE. In many oil provinces, the old buried structure will be rejuvenated by later folding. This arches the younger beds and gives a clue to the presence of a deeper oil field.

3.—TRUE. The seismic survey can be very effective in mapping wedge edges under favorable conditions.

4.—FALSE. Improved mapping methods or new well control may make a new seismic survey advisable. More often than not, reconnaissance shooting will not give enough detail.

5.—FALSE. Surface geology is one of the cheapest forms of oil exploration, particularly in new oil provinces.

☐ ☐ 1. It is unusual for the different types of geological and geophysical surveys to be in agreement.

☐ ☐ 2. Maps on shallow seismic horizons sometimes give an indication of a deeper lead.

☐ ☐ 3. Seismic surveys can map truncated wedge-edges.

☐ ☐ 4. One seismic survey will usually give all the information needed in a new area.

☐ ☐ 5. Today, surface geology has very little value in oil exploration.

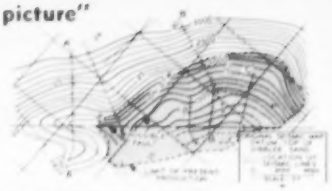
PROFITABLE GEOPHYSICAL CASE HISTORIES

GEOPHYSICAL PROSPECT

EXPLORATION HISTORY AND MAPPING METHODS

SOUTH CUYAMA

"A selling picture"



"Proof of the pudding"

Cuyama Valley was not highly regarded as oil country until the successful completion of the Norris Oil Co. No. 2 well in 1948. This well was completed for an initial potential of 200 bbls. per day flowing from a pay sand at 1,850 ft. Renewed interest in the area led to the geophysical work that outlined the South Cuyama structure.

The first seismic work was begun in February 1948 and found an interesting lead on the south side of Cuyama Valley in late June. The survey outlined a northwesterly dipping nose. The work was resumed in October 1948 and a new line was located southeast of the original work. This line, too, mapped the reversal.

Rugged topography seriously handicapped the field operations. The seismic results by some standards might be considered poor; however, in view of the terrain, the data are surprisingly good.

Continuous subsurface profiles were shot throughout the

GRAND ISLE, BLOCK 18

Inexpensive

But accurate

An underwater gravimeter survey in March 1946 uncovered the Grand Isle Block 18 lead during a reconnaissance survey of the continental shelf due south of New Orleans. Six crew days were spent outlining the area of interest. The results of the gravity work showed a pronounced gravity minimum, typical of piercement salt domes along the Gulf Coast.

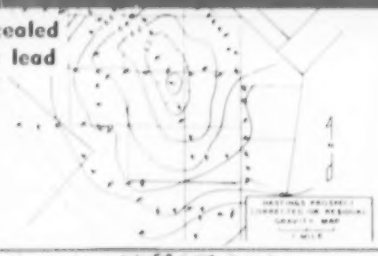
A reconnaissance seismic survey was commenced late in 1946. This survey mapped a large dome with a closure of nearly 1500 ft. at an approximate depth of 9,000 ft. A later survey after leases were acquired altered the original interpretation slightly.

In June 1947, an electrical survey was made of the prospect. The results of this survey checked very closely with the gravity and seismic work.

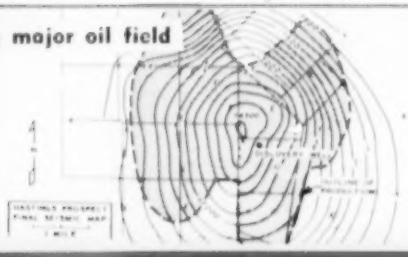
The final detailed seismic survey was carried out in August 1947. This survey used a radial shooting pattern over the crest of the inferred structures. Spread distances

HASTINGS

A concealed gravity lead



A major oil field



The Hastings anomaly was found by a Stanolind Oil and Gas Co. torsion balance crew in September, 1933. The lead, however, was largely obscured by a large regional gravity minimum on the north and the minimum over the Manvel dome on the west. At that period in gravity work, only major anomalies were considered worthy of further investigation. And by those standards, the Hastings anomaly was classified as a minor feature. Too many geologists felt that the anomaly was too close to the Manvel feature to be of interest.

Careful interpretation, however, showed a large residual gravity anomaly at Hastings that was definitely separated from the Manvel anomaly. The residual anomaly was arrived at by eliminating the effect of the regional gravity. The residual map produced a sharp clear picture of the Hastings dome. Additional torsion-balance work outlined the east side of the dome and acreage was purchased on the basis of the residual gravity anomaly.

DRILLING RESULTS AND OIL RESERVES

entire survey. Cross profiles were shot to get dip and strike control where the topography permitted. The profiles shot across the axial trend were tied by a strike line.

Seismic maps were based on phantom horizons and tied to the nearest well, located 4 miles north of the prospect. These maps showed crest of the South Cuyama anticline was 3,000 ft. higher than the well tie. And the structure had over 1500 ft. of relief.

DRILLING RESULTS . . . Richfield Oil Corp. completed the 1 Homan as the discovery well at South Cuyama. The well flowed 2,800 bbls. of oil per day from the Dibblee sand of Lower Miocene age. Development drilling has outlined a large complexly faulted anticline. None of these minor faults were mapped by the seismic survey. This, however, is understandable because the displacement on most of these faults is less than 100 ft. This type of faulting can only be mapped by accurate correlation of good reflections.

The seismic survey predicted the general shape and relief

Test your oil-finding ability

TRUE FALSE

☐ ☐ 1. The first discovery in a new area can be ignored.

☐ ☐ 2. Poor geophysical results are better than none.

☐ ☐ 3. In complex areas, it is wise to obtain dip control.

☐ ☐ 4. Detailed geophysical work can map faults with small displacements.

☐ ☐ 5. It is always advisable to drill the initial test on the crest of the structure.

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were 1,000 ft. A shot was fired at each end of the spread to give continuous interlocking profiles and 100 per cent subsurface coverage. This interpretation showed a dome with some 400 ft. of relief at a depth of 6,200 ft.

DRILLING RESULTS . . . The discovery well was completed in August 1948. The well drilled into the salt core at 7,610 ft. and was finally completed in the sidetracked hole at a depth of 8,640 ft. The discovery had 147 ft. of net oil sand and flowed 878 bbls. or oil per day through perforations at 8,640 - 65 ft. Production at Block 18 has now been established in Pleistocene supercap sands at 1,740 ft. and in Pliocene-Miocene sands from 8,000 to 9,000 ft.

The section is made up of well-consolidated sands that do not show a tendency to shale out with depth. Development drilling has extended production around the south half of the dome. Preliminary estimates indicate that Block 18 will eventually produce at least 100 million barrels of oil.

The subsurface data agrees reasonably well with the seismic work. Seismic work outlined the salt mass quite ac-

☐ ☐ 1. Gravity surveys are excellent for detailing the extent and location of salt structures.

☐ ☐ 2. The electrical survey mapped the Block 18 dome and confirmed the other geophysical work.

☐ ☐ 3. Salt domes usually have several different producing horizons.

☐ ☐ 4. It is important to map the location of the salt plug prior to drilling.

☐ ☐ 5. Salt domes are noted for their high reserves and long producing life.

A reflection seismic crew was moved into the area in April 1934. The first day's shooting mapped 500 ft. of anomalous west dip. About one week's shooting mapped the structure. A 1,000-ft., six-trace spread was used with one seismometer per trace. The shot point was located in line with the spread and some 2,200 to 3,000 ft. from the center of the spread. It was custom to shoot the spread, move it a similar distance on the other side of and in line with the shot point and shoot the same hole again. This field method gave about 20 per cent subsurface coverage.

DRILLING RESULTS . . . The discovery well was spudded on October 28, 1934 and completed December 22, 1934. The well made 153 bbl. of oil per day; total depth was 5,990 ft. The well was worked over and recompleted May 1, 1935 for an initial potential of 320 bbl. per day.

The producing area coincides very closely with the structure mapped by both reflection work and shows a definite relationship to the gravity anomaly. The reflection work failed to map the faulting, but the work by today's

☐ ☐ 1. Regional gravity maps are better than residual maps for delineating local structures.

☐ ☐ 2. Even today seismic surveys are used to confirm gravity prospects prior to drilling.

☐ ☐ 3. The original seismic survey at Hastings was a costly affair, requiring months of detailed shooting.

☐ ☐ 4. The idea that salt domes cannot occur in close proximity is still valid.

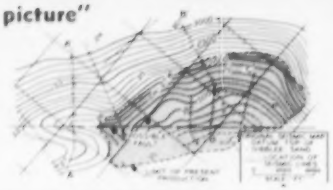
☐ ☐ 5. Drilling results at Hastings proved disappointing.

PROFITABLE GEOPHYSICAL CASE HISTORIES

GEOPHYSICAL PROSPECT | SIGNIFICANCE

SOUTH CUYAMA

"A selling picture"



"Proof of the pudding"

of South Cuyama remarkably well on what is considered a bare minimum of seismograph lines.

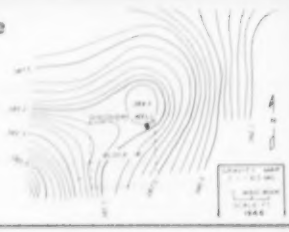
South Cuyama produced 12,674,000 bbls. of oil in 1955. Ultimate production from the field is estimated at 225,000,000 bbls. from 221 wells.

Fortunately the initial test was drilled downdip from the crest of the anticline since later drilling defined a gas-cap.

SIGNIFICANCE . . . Oil production at South Cuyama proves that geologists cannot eliminate any area by a convenient rule of thumb. Many California geologists had condemned the area with "there's no oil in Cuyama Valley." And it appeared that they were right until January 1, 1948 when the first oiler was completed. Actually, any sedimentary basin should be seriously considered as oil country. Wherever there are source and reservoir rocks and possible traps, the chances are good that you will find oil. And South Cuyama, a major oil field, is the kind of reward that the aggressive oil finder will uncover.

GRAND ISLE, BLOCK 18

Inexpensive



But accurate

curately. Radial faulting, however, was not picked up by the shooting. Mapping such faults would have required a more detailed and costly seismic survey.

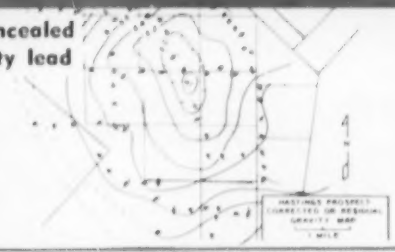
A total of seven geophysical surveys were made in the Grand Isle Block 18 area. Each survey contributed valuable information, but the original gravity and seismic work deserves the credit for uncovering this major field.

SIGNIFICANCE . . . Gravity surveys are the cheapest and most reliable reconnaissance method for locating piercement salt domes. Normally the dome is evident as a gravity minimum, since the salt has a lower density than the surrounding sediments. Several different methods were used in the exploration phase at Block 18. All the methods served to confirm the presence of the salt dome.

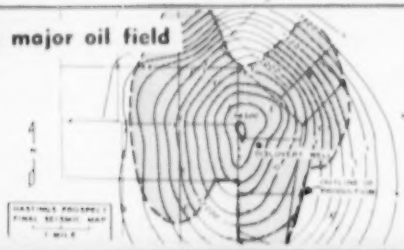
The discovery at Block 18 points up the wisdom of being there first in oil exploration. The original gravity survey probably cost under $10,000 and located a lead that will probably produce over $300,000,000 worth of oil.

HASTINGS

A concealed gravity lead



A major oil field



standards was of a reconnaissance nature. This type of field mapping gives the over-all picture, but no detail.

Hastings is a major oil field. It has already produced 264 million barrels of oil and will ultimately produce over 500 million barrels. It is still one of the largest oil reserves on the Texas Gulf Coast.

SIGNIFICANCE . . . Hastings is a good example of what optimistic oil-finders can uncover. The area had been condemned because it was too close to Manvel to produce. At that time it was thought that salt domes did not occur close together. Careful interpretation converted what appeared to be an insignificant lead into an anomaly of major importance.

The exploration cycle at Hastings has been repeated many times over on countless Gulf Coast salt domes. Careful gravity work uncovers a lead that is deemed worth shooting. The seismic survey delineates the lead and leases are acquired. At Hastings, the first well was successful. But on many salt domes, the oil is more elusive. Several tests are needed before the oil is in the tanks.

THE ANSWERS

1.—FALSE. Any discovery in a new producing area should be carefully evaluated. Most new oil provinces contain several large oil fields and these are found first. Thus, a rank wildcat may be the fore-runner for new oil fields.

2.—TRUE. In oil finding, any information is of value. At South Cuyama, the original seismic data left much to be desired, but the interpreters were able to map the lead with considerable accuracy.

3.—TRUE. The dip data gives a more reliable picture when the beds are dipping steeply. And this dip data can be used to advantage in planning additional seismic programs.

4.—TRUE. However, this should be qualified with the phrase, "under favorable conditions." When the displacement is less than 100 ft., the interpreter is working within the limit of error of the seismic method.

5.—FALSE. Many large structures have sizable gas caps. A test on the crest of such a structure will not evaluate the oil possibilities of the lead.

Test your oil-finding ability

TRUE FALSE

☐ ☐ 1. The first discovery in a new area can be ignored.

☐ ☐ 2. Poor geophysical results are better than none.

☐ ☐ 3. In complex areas, it is wise to obtain dip control.

☐ ☐ 4. Detailed geophysical work can map faults with small displacements.

☐ ☐ 5. It is always advisable to drill the initial test on the crest of the structure.

1.—FALSE. Gravity surveys are excellent for reconnaissance work. Usually the detailing is done with a reflection seismograph survey.

2.—TRUE. The location of the electrical anomaly coincided very closely with the seismic and gravity anomalies.

3.—TRUE. Invariably, salt domes have several pay zones. And oil sands can and often do occur below water-bearing sands.

4.—TRUE. The location of the salt plug is very important. Special seismic surveys will show the possibilities of production below an overhang.

5.—TRUE. Many salt domes, like Block 18, are major oil fields. This is one of the main reasons that offshore exploration is so attractive.

☐ ☐ 1. Gravity surveys are excellent for detailing the extent and location of salt structures.

☐ ☐ 2. The electrical survey mapped the Block 18 dome and confirmed the other geophysical work.

☐ ☐ 3. Salt domes usually have several different producing horizons.

☐ ☐ 4. It is important to map the location of the salt plug prior to drilling.

☐ ☐ 5. Salt domes are noted for their high reserves and long producing life.

1.—FALSE. Residual maps eliminate the effects of regional gravity. The regional often completely obscures the local anomalies that oil companies are seeking.

2.—TRUE. This is especially true along the Gulf Coast, both on land and offshore.

3.—FALSE. The seismic survey at Hastings required only about one week's shooting. As a matter of fact, one month's seismic work at that time (1934) cost only $7,500.

4.—FALSE. This idea belongs in the oil-finder's mental waste basket along with the adage "No oil in Cuyama Valley." Most of these rules of thumbs are handy crutches for geologists and geophysicists who are too lazy to think.

5.—FALSE. Nothing could be farther from the truth. Hastings is a major oil field and will ultimately produce over 500 million barrels of oil.

☐ ☐ 1. Regional gravity maps are better than residual maps for delineating local structures.

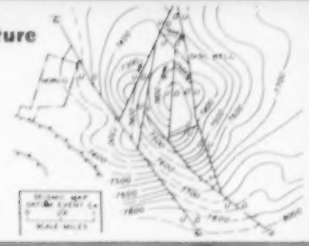
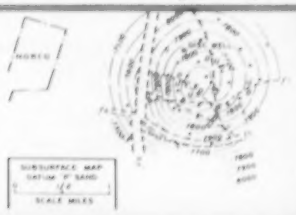
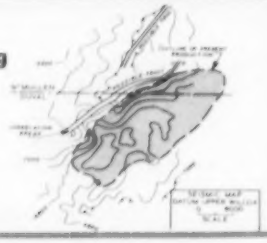
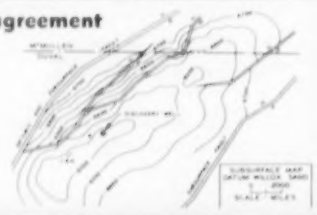
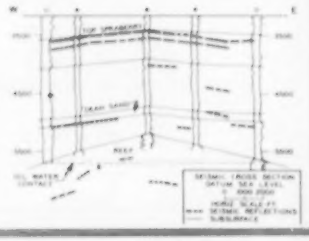
☐ ☐ 2. Even today seismic surveys are used to confirm gravity prospects prior to drilling.

☐ ☐ 3. The original seismic survey at Hastings was a costly affair, requiring months of detailed shooting.

☐ ☐ 4. The idea that salt domes cannot occur in close proximity is still valid.

☐ ☐ 5. Drilling results at Hastings proved disappointing.

PROFITABLE GEOPHYSICAL CASE HISTORIES

GEOPHYSICAL PROSPECT	EXPLORATION HISTORY AND MAPPING METHODS
GOOD-HOPE **Complex structure**  **But prolific** 	Good-Hope is a deep-seated salt dome that is evident as a gravity anomaly. The lead was originally mapped in 1935 and 1936 as a result of a torsion-balance survey. The first reflection seismograph crew worked the area in December 1942. Continuous profiles were shot during the survey. The results were generally fair in quality to a depth of 8,000 ft. This survey mapped a prominent deep structural uplift, roughly circular in outline. The folding is only weakly developed in the beds above 4,000 ft. At 7,500 ft., however, there is over 400 ft. of relief on the lead. The structure continues to increase with depth according to fragmentary dip data between 10,000 and 12,000 ft. The seismic data strongly suggested the presence of a graben on the crest of
HAGIST RANCH **Detailed shooting**  **Subsurface agreement** 	Geological studies showed that Wilcox production could occur in parts of Duval and McMullen counties of South Texas. Shallow subsurface control outlined an area of interest similar to a known seismic prospect that lay just to the northeast. This line of reasoning led to the taking of a geophysical option on the Hagist Ranch in August and September 1942. Originally the plan was to shoot the optioned area with reconnaissance work using continuous dip-profiling. Record quality was usable with two recognizable reflecting horizons. Shortly after the survey was started, very steep north dip was mapped. North dip is critical in this part of Texas since the regional dip is to the southeast. The reconnaissance program was abandoned in favor of closed loop shooting. The seismic survey mapped a pronounced anticlinal
GOOD **Permian beds**  **Reflect a reef** 	The Good Ranch area first attracted the attention of Seaboard Oil Co. early in 1948. The Pennsylvania reef masses at Spraberry Deep and at Vealmoor had just been discovered. The Good Ranch lay in possible "reef country" between these two oil fields. Also, the ranch appeared to be high regionally on a Permian marker. A core-drill map showed a shallow anticline with about 30 ft. of closure, indicating a high area in the northeastern part of the ranch. In August 1948, shooting was begun. In the initial phase, the crew shot 2-mile loops, using a 1320-0-1320-ft. split-continuous spread for the most part. The recording truck had a 20-trace recording unit; two seismometers were used per trace. Several reflecting horizons were identified to a depth of 6,000 ft. No event was ever identified, however, as coming from the reef itself. Preliminary shooting confirmed the area of interest in the northeast part of the ranch and the lead was detailed. Shot point density over the reef was approximately 35 per

DRILLING RESULTS AND OIL RESERVES

the structure. Structural closure was mapped within the down-faulted area.

The lead was mapped by at least two separate surveys, working for two different oil companies.

DRILLING RESULTS . . . Pure Oil Co. completed the discovery well at Good-Hope on August 28, 1944. There have been 43 wells drilled on the structure, and 36 of these were productive. Nine Miocene sands are commercial at drilling depths of 6,000 to 9,700 ft. Ultimate production is estimated at 38 million barrels of oil.

The typical fault pattern, gravity anomaly, circular nature of the field, and regional setting clearly indicate that Good-Hope is a deep-seated salt dome.

trend on the downthrown or coastal side of a normal fault. The anticlinal ridge parallels the major northeast-southwest trending fault. The survey required 100 working days from September 7, 1942 to February 9, 1943.

DRILLING RESULTS . . . The initial test on the Hagist Ranch lead was drilled in 1947. A threatened blowout at 9,349 ft. forced the operator to plug and abandon the well. The discovery well was completed in 1948. It was a gas-condensate producer from three sands in the Wilcox(Eocene).

Subsequent drilling proved up a structure considerably larger than that originally mapped. The original seismic survey, however, was apparently confined to the geophysical option and did not map the northeast extension of the field.

The field is a large anticline, 8 miles long and 2 miles wide. There are now 81 wells in the field. Four separate zones produce.

square mile.

Comparison of the seismic anomaly with known reef fields indicated that it, too, was a reef. The mapped lead was interpreted as a Permian structure caused by differential compaction and draping over a reef mass.

DRILLING RESULTS . . . The discovery well at Good was located on the crest of the seismic structure. The test found reef limestone at 7,900 ft. and was completed for 448 bbl. of oil per day.

The subsurface control conforms remarkably well with the original seismic data. The seismic work had mapped about 125 ft. of relief at Spraberry level and this agreed with well data. The relief on the reef itself, however, exceeded 400 ft. but the seismic work did not map the reef mass.

Development drilling outlined some 2,000 productive acres at Good. In 1955 the field produced 1,292,000 barrels of oil from 48 wells. Good has already produced 10 million barrels of oil and its ultimate production will reach 27 million barrels.

Test your oil-finding ability

TRUE FALSE

☐ ☐ 1. Deep-seated salt domes are confined to the Texas and Louisiana Gulf Coast.

☐ ☐ 2. Deep-seated salt domes usually have a typical fault pattern with a graben on the crest of the structure.

☐ ☐ 3. Both gravity and seismic surveys are useful in pin-pointing deep-seated salt domes.

☐ ☐ 4. Many of the Gulf Coast salt domes increase in intensity with depth.

☐ ☐ 5. Many Gulf Coast salt structures have very similar exploration histories.

☐ ☐ 1. Seismic work has not proved very successful in mapping fault closures in Southwest and South Texas.

☐ ☐ 2. Many oil fields in Southwest Texas are related to down-to-the-coast faults.

☐ ☐ 3. Oil production usually occurs on the upthrown or landward side of the down-to-the-coast faults.

☐ ☐ 4. Close coordination between geologists and geophysicists will aid materially in finding new oil fields like Hagist Ranch.

☐ ☐ 5. In reconnaissance mapping, any interruption of regional dip is important.

☐ ☐ 1. The seismic work at Good accurately mapped the reef surface, showing some 400 ft. of relief.

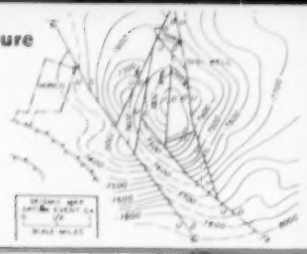
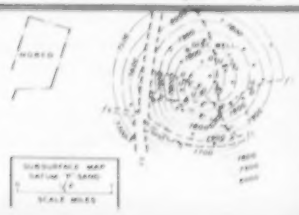
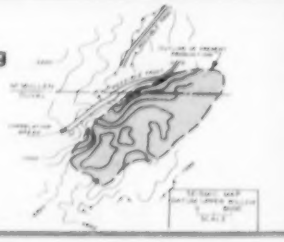
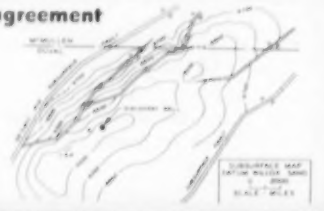
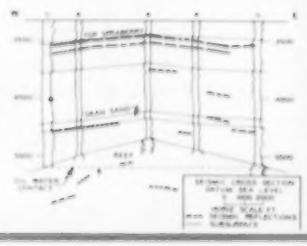
☐ ☐ 2. The discovery at Good was the result of haphazard shooting in a new area.

☐ ☐ 3. The seismic work and the subsurface data are in close agreement at Good.

☐ ☐ 4. The seismic anomaly at Good did not resemble the other reef oil fields in the area.

☐ ☐ 5. Reef structures often appear to intensify with depth on seismic cross sections.

PROFITABLE GEOPHYSICAL CASE HISTORIES

GEOPHYSICAL PROSPECT	SIGNIFICANCE
GOOD-HOPE Complex structure  But prolific 	SIGNIFICANCE . . . Good-Hope has many of the characteristics of the prolific deep-seated salt domes, common to the Gulf coast. More often than not, these structures have a typical fault pattern with a downthrown block or graben on the crest of the structure. Apparently the fault pattern is the result of simple vertical compression. The two forces involved are the movement of the salt upward and the weight of the sediments acting downward. The deep-seated salt domes are remarkably prolific and are commonly found along the Gulf Coast. However, they are not confined to this area, because several fields in North Louisiana, Mississippi, and East Texas have similar fault patterns. Production on the deep-seated domes can and does occur in any or all of the fault blocks and in the central graben.
HAGIST RANCH Detailed shooting  Subsurface agreement 	SIGNIFICANCE . . . Hagist Ranch is typical of many oil fields in Southwest and South Texas. These fields are related to down-to-the-coast normal faults. Production occurs on the downthrown or coastal side of the fault. Frequently, as at Hagist Ranch, there is actual turnover into the fault. And the structure becomes a faulted anticline. The size of the producing area and closure will vary considerably from field to field. However, detailed seismic surveys have proved very effective in mapping these features. The discovery of Hagist Ranch is attributed to successful coordination between geology and geophysics. The endeavor typifies the optimum results obtainable when seismic and subsurface methods are combined and exploited to the fullest.
GOOD Permian beds  Reflect a reef 	SIGNIFICANCE . . . Good oil field was one of the first West Texas Pennsylvania reef fields that was deliberately looked for and discovered as such. Each step in its exploration history was specifically designed to find a productive reef within a rather limited area using a particular exploration idea. The discovery of Good re-emphasizes the value of: 1. Recognizing a trend early. 2. Setting up a specific objective. 3. Using the proper exploration technique. 4. Interpreting the results in terms of recent discoveries. Good has some of the seismic characteristics of a typical reef. The reef is weakly reflected in the overlying beds as a compaction structure. Erratic dips indicate that the structure intensifies with depth. Slight thinning occurs in the beds overlying the reef. Under favorable conditions, it is possible to prepare isopach maps of the interval in which the reef occurs. Because of the high velocity of the reef material, a pseudoanomaly or false thinning is mapped.

THE ANSWERS

1.—FALSE. Several fields in East Texas, North Louisiana, and Mississippi are related to deep-seated salt movement.

2.—TRUE. The typical fault pattern is characteristic of many of the deep-seated domes.

3.—TRUE. However, because of the low relief, the deep-seated domes are much harder to map with gravity work than the piercement domes.

4.—TRUE. On many of the domes, the structure was actually growing during the time of deposition. This means that the relief on the structure becomes greater with depth.

5.—TRUE. A review of the exploratory history of many of the Gulf Coast oil fields shows a marked similarity from field to field. . . . A gravity lead that was confirmed by seismic work and subsequent drilling.

Test your oil-finding ability

TRUE FALSE

☐ ☐ 1. Deep-seated salt domes are confined to the Texas and Louisiana Gulf Coast.

☐ ☐ 2. Deep-seated salt domes usually have a typical fault pattern with a graben on the crest of the structure.

☐ ☐ 3. Both gravity and seismic surveys are useful in pin-pointing deep-seated salt domes.

☐ ☐ 4. Many of the Gulf Coast salt domes increase in intensity with depth.

☐ ☐ 5. Many Gulf Coast salt structures have very similar exploration histories.

1.—FALSE. Detailed seismic work is particularly effective in mapping these Gulf Coast and Southwest Texas fault closures.

2.—TRUE. The down-to-the-coast fault interrupts the regional dip. The oil, migrating updip, is trapped against the fault.

3.—FALSE. Most of the fields produce on the downthrown or coastal side of these faults.

4.—TRUE. Geologists can outline areas of interest that can be readily checked with shooting. This statement holds true for both regional and local geophysical program.

5.—TRUE. Any interruption of regional dip may be the only clue needed to uncover a new oil field.

☐ ☐ 1. Seismic work has not proved very successful in mapping fault closures in Southwest and South Texas.

☐ ☐ 2. Many oil fields in Southwest Texas are related to down-to-the-coast faults.

☐ ☐ 3. Oil production usually occurs on the upthrown or landward side of the down-to-the-coast faults.

☐ ☐ 4. Close coordination between geologists and geophysicists will aid materially in finding new oil fields like Hagist Ranch.

☐ ☐ 5. In reconnaissance mapping, any interruption of regional dip is important.

1.—FALSE. Mapping at Good outlined the Permian structure with 75—125 ft. of relief caused by the reef. The reef has at least 400 ft. of relief.

2.—FALSE. Good was the result of a carefully designed exploration program.

3.—TRUE. The geophysical and geological data agree remarkably well.

4.—FALSE. Comparison of the seismic data with two known reef fields indicated that the seismic anomaly was a Permian structure caused by draping or compaction over a Pennsylvanian reef.

5.—TRUE. This is caused in part by the high velocity reef material. The result is a false structural apparent on seismic cross-section.

☐ ☐ 1. The seismic work at Good accurately mapped the reef surface, showing some 400 ft. of relief.

☐ ☐ 2. The discovery at Good was the result of haphazard shooting in a new area.

☐ ☐ 3. The seismic work and the subsurface data are in close agreement at Good.

☐ ☐ 4. The seismic anomaly at Good did not resemble the other reef oil fields in the area.

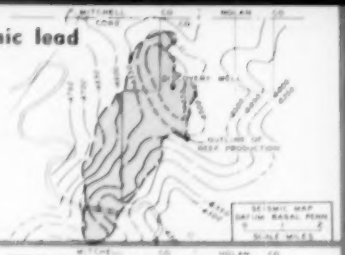
☐ ☐ 5. Reef structures often appear to intensify with depth on seismic cross sections.

PROFITABLE GEOPHYSICAL CASE HISTORIES

GEOPHYSICAL PROSPECT	EXPLORATION HISTORY AND MAPPING METHODS

JAMESON

A weak seismic lead



But a major oil field

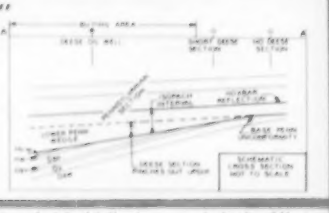
First attention was focused on Jameson in July 1922 when a Sun Oil Co. geologist mapped two small surface structures in northwest Coke County. However, no action was taken on the basis of this early work. In 1944, Sun acquired 10,000 acres on the northern surface structure.

A regional subsurface map prepared in 1945 from shallow well data tended to support the idea that there was a lead in the Jameson area. During early 1946, the Jameson area was shot.

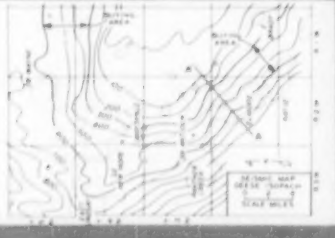
Record quality was quite poor on this seismic survey, especially in the southern three-quarters of the prospects. There was some thought of abandoning the survey in view of the questionable data. In spite of the poor record quality the interpreter was able to map a small closure on the north end of the prospect. The discovery well was drilled on this lead. The lead corresponded quite closely with the surface

GOLDEN TREND

"Strat Trap"



Mapped by shooting



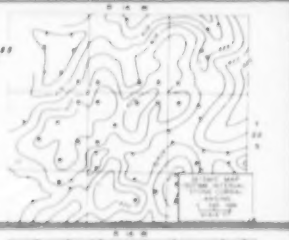
Prior to 1946, oil companies had concentrated on finding structural traps on the Pauls Valley uplift that lies 50-60 miles due south of Oklahoma City. Nearly all the production was from pre-Pennsylvanian rocks and these reservoirs were the primary targets for nearly all wildcats.

The concept of stratigraphic traps took on major importance among oil-finders when Globe Refining Co. and Vickers Petroleum Co. completed the 1 Gibson in February 1946. The well produced from a Deese sand (Lower Pennsylvanian). Industry suddenly realized that production was controlled by stratigraphy rather than structure. The well touched off a leasing and drilling campaign that subsequently outlined oil reserves in excess of 132 million barrels.

Fortunately, Carter Oil Co. had considerable seismic data in their files covering the Pauls Valley Uplift. From the data, it was possible to map the pinchout of the Deese sediments and forecast quite accurately areas where the Deese sands

SMALLWOOD

Seismic "Pimple"



Confirmed by drilling

Production in this part of Stafford County, Kansas is controlled by relief as low as 10 ft. Conventional techniques in the area had failed to yield oil discoveries because they were not accurate enough to map closures this small.

The initial work at Smallwood consisted of correlation points shot at each section corner and in the center of each section. With this method, additional control is added by shooting in the center of each quarter section if a lead is mapped. The correlation method works well in the area because the important reflections are readily identifiable and record quality is good.

Six days seismic work defined the Smallwood lead.

Maps were prepared using the anhydrite method. In this method, no weathering corrections are applied. The Stone Corral anhydrite is a persistent and reliable geological and seismic marker. It is used as a reference plane and all subsequent reflections are referred to the Stone Corral. In effect, the Stone Corral is considered to be flat and isochron or

DRILLING RESULTS AND OIL RESERVES

structure mapped in 1922.

DRILLING RESULTS . . . The discovery well at Jameson was completed December 13, 1946 for a daily potential of 168 bbls. of oil. The top of the reef was encountered at 6,200 ft. Reef production now covers some 6,000 acres at Jameson. The reef has a maximum buildup of about 800 ft. And this buildup occurs entirely within the Canyon-Strawn black-shale section.

Jameson was one of the first reef fields discovered on the eastern side of the Midland basin. The surface structures appear to be related to renewed tectonic movement rather than actually reflecting the reef itself. These positive features are evident in beds above and below the reef and hence are probably independent of the reef. Ultimate production at Jameson will approach the 100 million barrel mark. This includes a large strat trap on the flank uncovered by later drilling.

Test your oil-finding ability

TRUE FALSE

☐ ☐ 1. The surface anticlines at Jameson persist at depth.

☐ ☐ 2. The reef build-up at Jameson is about the same size as the relief of the seismic structure.

☐ ☐ 3. Jameson was one of the first reefs found in this general area.

☐ ☐ 4. Jameson could be termed a fortunate accident.

☐ ☐ 5. Record quality on the Jameson prospect was quite good.

should occur and be productive.

The seismic maps were tied to available well control. A buying area was outlined in which the Deese sand was expected. The updip limit (see map and cross-section) was based upon well data. The downdip limit was arbitrarily set since no well control was available.

DRILLING RESULTS . . . The bit proved up considerable Deese sand production. Although considered optimistic at the time, the downdip limits of the buying area were too conservative. The Deese pools of Katie and Elmore were outside of the buying area.

In the extreme northern rim of the buying area, the Deese section did not contain any sands. This, however, could not be forecast from the data then at hand. But on the whole, the drilling results confirmed the validity of the lease play.

Subsequent drilling has uncovered additional strat traps further downdip than the Deese production. The Springer

☐ ☐ 1. Seismic work can be effective in mapping strat traps.

☐ ☐ 2. The Deese production on the Golden Trend proved to be local in extent.

☐ ☐ 3. It pays to review old seismic data in the light of new developments.

☐ ☐ 4. Prior to the Deese production, oil companies were actively searching for strat traps along the Pauls Valley uplift.

☐ ☐ 5. It was difficult to forecast the downdip limit of Deese production because of lack of well control.

time interval maps are prepared on markers below the Stone Corral. This method eliminates any velocity errors from the beds above the Stone Corral. Isochron thins are excellent criteria for drillable seismic prospects.

The seismic work mapped a thinning in the beds below the Stone Corral in the Smallwood aera.

DRILLING RESULTS . . . Drilling has tended to confirm the initial interpretation at Smallwood, two small oil fields with 22 producing wells. Pay zones are the Lansing and Arbuckle limestones. The interval maps in particular have stood up under the impartial scrutiny of the bit, although the amount of thinning is small, on the order of 25-30 ft. The producing closure at Lansing level is probably less than 30 ft.

Actually the seismic work mapped two separate structures, the Smallwood and the West Curtis fields. These are separated by a narrow syncline.

Smallwood is typical of the microstructures common to

☐ ☐ 1. The anhydrite method accentuates near-surface velocity errors.

☐ ☐ 2. In the Mid-Continent, microstructures normally are low-relief anticlines.

☐ ☐ 3. Geophysics is cheap insurance for the small operator in the Mid-Continent.

☐ ☐ 4. Conventional seismic mapping methods are successful in mapping structure in the Smallwood area.

☐ ☐ 5. The correlation method of shooting gives reliable results in parts of Kansas.

HOW DO YOU RATE GEOPHYSICAL PROSPECTS?

Here is how some of the nation's leading oil finders grade these prospects. These definitions are based upon a Journal survey among the nation's top geophysicists.

Granted many factors affect the proper evaluation of a prospect . . . local and regional geology, size of the lead, the acreage situation, possibility of dry-hole contribution, proximity to production, possible oil reserves, type of pay zone present, etc. But here is what leading geophysicists say about geophysical prospects and how they define the various grades of seismic leads.

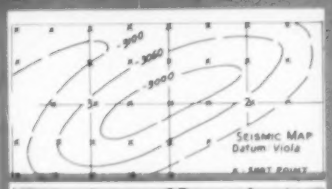
GRADE A PROSPECT

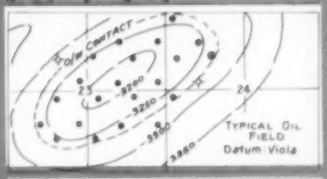
Chief geophysicist, major oil company, Tulsa . . . "An adequate structure or closure for the area involved, supported by seismic checks on the dips, thinning of the beds, multiple horizon checks, etc. . . . The presence of the prospect appears nearly certain. The data are good."

Consulting geologist-geophysicist, Fort Worth . . . "Any drillable anomaly on which sufficient acreage can be leased to warrant the drilling of a wildcat well."

Head of large contract seismograph company, Tulsa . . . defines it this way, "A well-defined structure in a productive area with adequate control (velocity and surface corrections as well as density of shooting), based on good quality records."

Geophysicist and co-owner, small contracting company, Houston . . . "My definition is . . . Complete closure, sufficient for the particular area; velocity control through established wells or dry holes or slim holes, and 'positive geology'."





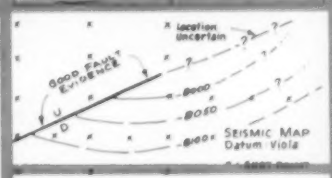
GRADE B PROSPECT

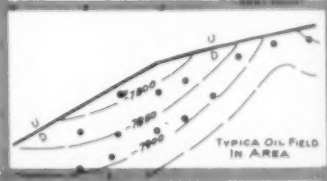
Geophysical coordinator, major company, Midland, Tex. . . . "We consider that a Grade B prospect is a seismic anomaly that would fall in Grade A category, but lead falls in an area where the potential reservoirs are unknown . . . or a prospect where critical dip may be weak."

Independent operator, Ardmore, Okla. emphasizes the lease picture on Grade B prospects . . . "Any drillable anomaly upon which acreage can be leased but full lease control cannot be obtained. On these anomalies, an effort should be made to work out a drilling deal with neighboring lease holders."

President, small geophysical company, Oklahoma City, puts it this way, "It's a prospect that needs additional shooting to define extent and to confirm closure before drilling. Data are good enough to permit purchase of acreage unless acreage cost is excessive."

Exploration manager, small independent, Tulsa, looks at "B" prospects favorably, and states, "These are good seismic anomalies, but either some of the certainty is lacking, or there is less than adequate closure."





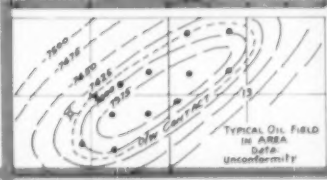
GRADE C PROSPECT

President, contract geophysical company, Dallas, comments . . . Grade C prospects need more shooting or are based on questionable data . . . "Or the areal coverage and the closure are marginal, that is, smaller than a typical oil field in the area."

Consultant, Oklahoma City, dismisses this type prospect with, "Any prospect that is graded this low or lower simply falls into a regional play and cannot be rated as a prospect."

Exploration manager, large oil company, Houston, rates a C prospect as . . . "one where closure or reversal is possible but not confirmed. Additional control is needed to confirm the lead even before buying acreage."

Prominent geophysicist, Mid-Continent area, upgrades C prospects with this comment . . . "A prospect lacking certainty but the prospect would appear good if it were actually there . . . My 20 years experience has shown that *most oil strikes apparently fall in this category.*"



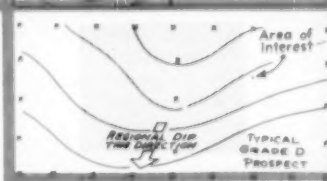
GRADE D PROSPECT

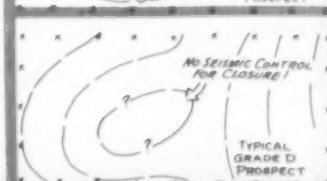
Vice-president, contracting seismograph company, Tulsa, comments, "Grade D prospects usually turn up in wildcat country. The closure is based either on poor records or on questionable weathering control."

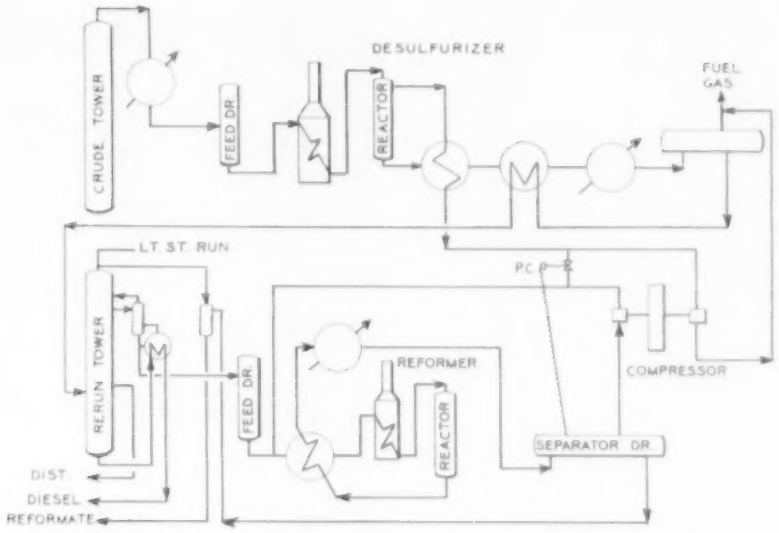
President, large exploration company, does not hold out much hope for Grade D prospects. He describes them as . . . "Prospects which may look all right on the map, but they are based on unreliable or sparse data. More often than not, there is no actual closure, simply terracing or nosing."

Vice president in charge of field operations, a small seismograph company, states . . . "These prospects usually depend upon the imagination of the interpreter, not on definite facts."

And one past president of the Society of Exploration Geophysicists sums up his feelings on Grade D prospects with "... An anomaly that is either too small or approaches the limit of the interpretative accuracy. It is devoid of charm or appeal. It is usually only a fly in the ointment of regional dip. It must not be entirely neglected and it should be investigated. Unfortunately, the Grade D prospect is usually merely farmed out."







CONTINENTAL OIL CO. installation at Billings, Mont., employs single-case reforming to generate hydrogen for Unifining.

Problem: Better sulfur removal in diesel fraction: Solution . . .

Single-Case Reforming Teams Up With Unifining

Result: So far a winning combination

by R. L. Adee

CONTINENTAL OIL CO.'s catalytic reforming installation at Billings, Mont., is an unusual application of the process, covering a region of operation not usually encountered.

Heavy black Wyoming crudes yield a relatively low percentage of straightrun gasoline; when coupled with a high yield of catalytically cracked gasoline the "octane pinch" has not been as severe in this region as it has in other parts of the country. For this reason, it was felt that catalytic reforming for octane was not necessary as yet at Billings but would probably be required sometime later.

Sulfur Problem

These heavy crudes, however, have the disadvantage of having a high percentage of sulfur. Our Billings refinery was built with a fluid desulfurizer licensed by Standard Oil Development Co. This unit was essentially a fluid cracking unit operated at mild enough conditions so that the cracking which occurred would not ruin distillate stability. This process gave good sulfur removal in the gasoline range but removed only about half of the sulfur in the diesel fraction. To obtain better sulfur removal in the diesel fraction, we decided to convert to Unifining. This required a source of hydrogen.

Description of Unit

Since reforming for octane was not necessary our reformer was designed to be a hydrogen factory with provisions for later expansion to a conventional type of reformer. To protect the reforming catalyst, the naphtha is charged to the desulfurizer with the rest of the crude-tower overhead (diagram). Since the refinery was built with a desulfurizer for all straightrun products our crude tower is strictly a topping unit. All straightrun streams down through diesel are taken overhead as one cut. The former desulfurizer took this cut as a vapor feed. Due to the high pressure of the Unifining process it was necessary to install condensing equipment so that the distillate could be pumped to the new unit.

The desulfurizer feed is pumped cold to the furnace. The recycle hydrogen is heated by exchange with the reactor effluent and is mixed with the oil in the top of the reactor. The reactor effluent is cooled by exchange and condensed. The hydrogen is separated and a small purge stream released to the fuel system to maintain purity. The remainder is returned to the reactor with the total make from the reformer.

The liquid from the separator drum is heated by exchange with the reactor effluent and charged to the rerun fractionator where the usual straightrun fractions are separated. The one unusual feature is a reboiled stripper for the naphtha side cut.

Naphtha flow . . . This is directly from the stripper to the reformer charge pumps. The feed surge drum is merely a wide spot in the line. Purpose of this drum will be discussed a little later. The reformer flow is standard except for the furnace and one reactor. The hydrogen and naphtha are mixed and heated by exchange with the reactor effluent. The furnace finishes heating the mixture to the desired temperature. The reactor effluent is cooled by the feed exchangers and condensed. Recycle hydrogen is returned to the reactor with the make hydrogen released to the desulfurizer on reformer pressure control.

The reformate is stabilized in a steam stripper which vents to the rerun fractionator overhead condenser.

Since any upset in the desulfurizer or the rerun fractionator might throw the naphtha stream off specification, the reformer feed surge drum is necessary so that the naphtha stream can be cut to slop and allow the reformer to run on drum inventory until the upset has been corrected.

Startup . . . Now we can see how we have worked ourselves into a vicious circle. The reformer must go on stream first to produce hydrogen for the desulfurizer and the desulfurizer produces the feed for the reformer. To escape our dilemma the reformer is started with naphtha from storage and switched to direct feed as soon as the desulfurizer is on stream.

Operation

Our basic operating philosophy has been to operate at maximum charge rate at the lowest temperature that will produce the necessary amount of hydrogen for Unifining. Since the naphtha feed has been Unifined there should be no poisons which would damage the

Author is with Continental Oil Co. Paper presented at W.P.R.A., Casper, Wyo., meeting.

reforming catalyst and thus the lowest possible operating temperature should give maximum catalyst life. Since increased octane is not worth the resulting yield loss the aim is to produce the necessary hydrogen with the minimum yield loss.

Hydrogen efficiency factor . . . In order to help correlate data I have been using a factor which for want of a better name is called hydrogen efficiency factor. This factor is the hydrogen yield in cubic feet per barrel multiplied by the per cent reformate yield. This factor does not tell the whole story, however, because the prime consideration is still the total barrels lost.

The maximum charge rate is limited by the amount of acceptable material below 400° e.p. which can be drawn from the tower. The initial boiling point is limited by the lowest tower-top temperature which will safely take all the stripping steam overhead. These limitations give us a normal charge stock with the characteristics shown in the first column of Table 1. The resulting reformate has the characteristics shown in the second column. A 10-octane-number increase and 42.5 per cent naphthene conversion will look strange to those accustomed to looking at results from octane reformers. The normal operating data are presented in Table 2.

Space velocity . . . When considering the high space velocity it should be remembered that this is for one reactor. Thus the space velocity is actually less than the space velocity through the first reactor of a conventional reformer. For those familiar with recycle ratios expressed on a molal basis the ratio as expressed here in cubic feet per barrel is approximately 1,000 times the molal ratio; it is much easier for the operator to talk about and understand cubic feet per barrel.

Run variations . . . We have data on two variations from the so-called normal operating conditions. These runs were made to check our basic operating philosophy. Our first change was to divert part of the full-boiling-range charge stock to storage. We found that a slightly higher temperature was necessary to maintain the same rate of hydrogen production. The higher temperature and lower space velocity resulted in a lower hydrogen-efficiency factor. We also experienced a lower percentage yield but even more important the total liquid barrels lost increased.

This pointed out the fact that the most economical operation would be to fill our startup storage as slowly as practical. The faster the storage is filled the greater is the total loss. However, this is offset by the anxiety of facing a possible emergency shutdown without enough naphtha on hand to start up again. Of course it would be possible to start the reformer on light straightrun gasoline since it has a high enough end point to contain a considerable amount of naphthene. Thus, we plan to keep the light straightrun tank fairly full when the naphtha tank is low.

Light-naphthene charge . . . The largest source of hydrogen per barrel of feed is available from the light naphthenes. In order to check the over-all efficiency of this type of charge stock we operated for a short time with a lower-end-point feed. We found that it was not necessary to raise the temperature of reactor feed this time. The reforming reaction is very sensitive to space velocity and the decreased space velocity at the lower charge rate increased severity enough that we yielded nearly the same amount of hydrogen from a smaller amount of charge. The hydrogen-efficiency factor increased as expected. However, the total barrels lost also increased. For a given amount of charge the lower-end-point material is more efficient. However, it is more efficient from the hydrogen-production standpoint to keep the unit loaded to the capacity of the charge pump as long as suitable charging stock is available.

Hydrogen purity . . . Let's look for a moment at the hydrogen purity. When the charge rate was reduced with a full-boiling-range feed we lost hydrogen purity. This indicated that we were splitting off small side chains by hydrocracking. The high hydrogen purity from normal operation indicates very little hydrocracking was occurring then. Now when charge rate was reduced by lowering the end point of the feed there was no loss of hydrogen purity, although the total loss of yield was about the same. This bears out the logical supposition that the heavier molecules are more easily hydrocracked. It also shows that the volumetric loss when heavy naphthenes are converted to aromatics without hydrocracking is not as great as with the lighter naphthenes.

Catalyst age . . . With only 4 months of operation behind us this about covers our finding to date. When I left Billings we had passed the 100-bbl. per lb. of catalyst age without an apparent decline in catalyst activity. We hope to reach 300 bbl. per lb. before regeneration. Only time can bear this out.

The mechanics of operation of the reformer have been extremely smooth. Our only difficulties have been in lining out the desulfurizer. As seen in the diagram, there is no way of preheating the desulfurizer catalyst bed before oil is admitted. The rerun fractionator must struggle along without heat until the desulfurizer is up to temperature. A few minor changes are being made during the current turnaround to correct this difficulty.

A line from the compressor discharge to the furnace inlet will allow us to preheat the catalyst case before oil is admitted. This should cut down immensely upon the amount of oil which has to be rerun following a startup. We had an early valve failure on the reformer compressor cylinders; however, the replacements were the same type and are still giving good service.

TABLE 1—NORMAL STREAM TESTS

	Feed	Reformate
Gravity	55.4	52.9
I.b.p.	208	210
50 per cent	274	274
E.p.	386	392
P.O.N.A.:		
Paraffins	49.1	54.8
Olefins	1.0	0.7
Naphthenes	33.7	18.8
Aromatics	16.2	25.7
Naphthene conversion		42.5
Octane:		
F-1 clear	48.0	58.6
+3 cc.	72.9	84.3

TABLE 2—USUAL OPERATION

Charge, bbl. per day	2,100
L.H.S.V.	10.3
Recycle-gas ratio, cu. ft./bbl.	12,600
Reactor inlet temperature, °F.	918
Reactor delta T, °F.	67
Hydrogen purity, per cent	96.5
Hydrogen yield, cu. ft./bbl.	380
Hydrogen efficiency factor	368
Liquid yield, per cent	96.8

TABLE 3—VARIATIONS FROM USUAL OPERATION

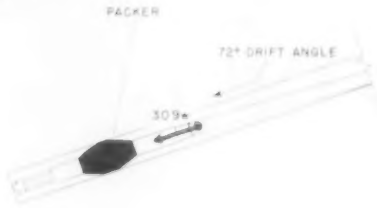
		Reduced charge rate	
	Normal	Normal boiling range feed	Lower end point feed
L.H.S.V.	10.3	8.7	8.8
Recycle ratio, cu. ft./bbl.	12,600	11,600	14,400
Reactor inlet, °F.	918	925	918
Delta T, °F.	66	73	64
H_2 purity	96.5	94.4	96.4
H_2 yield, cu. ft./bbl.	380	330	450
Liq. yield	96.8	89.3	91.0
Bbl. lost	67	156	156
H_2 eff. factor	368	295	405
Charge:			
Gravity	55.4	55.2	55.9
I.b.p.	208	208	208
E.p.	386	382	367
F-1 clear	48.0	48.0	
+3 cc.	72.9	72.7	
Reformate:			
Gravity	52.9	53.2	53.9
I.b.p.	210	200	212
E.p.	392	388	374
F-1 clear	58.5	58.6	58.6
+3 cc.	79.9	81.3	84.3

DRILLING

Drill-Stem Testing in *HIGH-ANGLE* Directional Wells

Signal has been testing in holes deflected more than 70° from vertical

by C. C. Liedholm



SETTING PACKER is difficult because of the weight of the string resting on the lower side of the hole. Drill collars in the nearly vertical section add needed weight.

DRILLING and completing high-drift-angle directional wells has been a routine operation for Signal Oil & Gas Co. in several areas along the California coast. Prior to 1956, however, drill-stem testing in open hole was never attempted in these high-angle wells. Other methods for zone evaluation were satisfactory. The additional information to be gained from testing was not considered important enough to justify the hazard.

Early this year Signal began developing a tideland lease for the city of Redondo Beach, Calif. It was apparent from the start of this operation that: (1) Some of the first wells drilled were to be deviated at drift angles in excess of 70° from vertical, (2) drill-stem testing would be necessary for proper evaluation of all possible productive zones.

Start of program . . . Signal, as operator for a group which includes Reserve Oil & Gas Co. and Artnell Oil & Gas Co., spudded the first well at Redondo Beach in March 1956. By June the third well was being tested in hole with an inclination of more than 65° off vertical. Successful drill-stem testing is currently being conducted in the fourth well at an inclination in excess of 70°, or less than 20° from horizontal. Specific techniques for this operation were developed during testing the lower-angle wells at Redondo Beach. Experience gained from working in hundreds of directional wells, including drill-stem tests inside casing, lent basic understanding for analyzing the problems and setting up the testing program.

The author is chief petroleum engineer, Signal Oil & Gas Co., Los Angeles.

Hazards . . . Any time a drill-stem tester is run in open hole there is danger of losing the hole, or a part of it. This may be due to permanently sticking testing tools or may result from damage to the hole while pulling the tester. In a high-angle well the hazards are no different, but they are magnified by factors which do not exist in straight holes. Also, in a high-angle hole surface control of bottom-hole equipment is not always effective. The following is typical test procedure developed for high-angle wells. An explanation of tools, methods and precautions which may be unique is included.

Pretest precautions . . . Casing is cemented through that portion of the hole in which drift angle is built (curved part in figure) prior to testing. Otherwise, the drill string may be pulled tight into key seats on the high side of the hole when pulling or jarring the tester loose.

Test is to be made in 160 ft. of 7⅝-in. rathole. Remainder of open hole is 8¾-in. Prior to testing, the hole is circulated clean from bottom. The bit is pulled up, and the 8¾-in. hole is circulated clean from several depths. This is designed to remove cuttings which accumulate along the low side of high-angle directional wells. The bit is run back to bottom before pulling out to test.

Tester setup . . . Conventional testing tools are used. These include 140 ft. of perforated, flush-joint tail pipe, 7-in. double packers of latest design, hydraulic valve assembly, and rotating type of shutin and reverse-circulation valves. The usual safety joint, jars, and bumper sub are included.

Another bumper sub is used in the middle of the tail pipe. If the tail pipe should become stuck, the top section can be jarred loose first; then the lower half can be jarred out.

A sub with blowout plugs is run above the reverse-circulation valve. This makes it possible to circulate out the recovery in the event of plugging or failure of the circulation valve. A

rotating type of circulation valve is used because a bar dropped from the surface will stop before reaching the tools in a 70° angle hole.

It is difficult to obtain sufficient weight above the tools to expand the packers. As shown in the figure, only 30 per cent of the weight of the string is effective in a downhole direction at 72° drift angle. This is probably not enough to overcome the frictional resistance at this angle. By running 90 ft. of drill collars in the almost vertical portion of the hole, 99 per cent of the weight of the collars can be transmitted down the hole to actuate the packers.

Testing procedure . . . The tester is set with the top packer approximately 5 ft. into the rathole. Consequently, it is necessary to raise the tools 10 ft. before both packers are in the 8¾-in. hole. Regardless of extreme care in cleaning up the hole, enough cuttings can remain to stop the packers if dragged very far through 7⅞-in. hole.

The open portion of the test is limited to approximately 1 hour. A 15 to 20-minute shutin period follows. All but 180 ft. of the recovery is reverse circulated out.

Results of testing . . . Twelve separate open-hole tests have been run to date in the 72° drift-angle fourth well. All tests were technically successful, although not indicative of oil production.

Drill-stem testing is possible today in high-angle wells because of advances in tool design made by the testing companies. This is particularly true of open-hole packers. Another factor of importance is the ability, perseverance, and perceptiveness of Signal's field men. The ideas which make it practical to test these wells were originated on the derrick floor by men who are constantly looking for a better way to do a job.

Wire-Line Cementing Tool Has Many Uses

Wire-line squeeze cementing is a fast way to plug off holes, squeeze perforations, or repair casing leaks. With this tool, placement position is positive and cement is relatively uncontaminated.

by D. H. Stormont
District Editor

A NEW wire-line cementing tool and bridging plug which uses gas-generated power to seat the plug and propel the cement from the tool is finding a variety of uses in California fields.

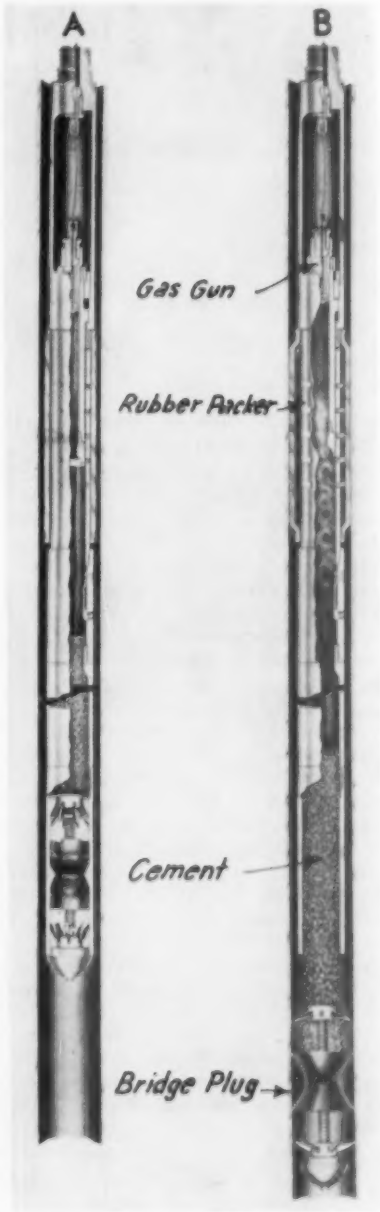
First used for setting bottom plugs, and to shut off water in thin oil sands, it now is being used to scab off intermediate water sands, in high gas-oil ratio wells to shut off the gas intervals, for setting liners, and for repairing leaky casing. The tool also is finding increased use in high-angle holes where bridging plugs can't be set by conventional wire-line tools.

Most work has been carried out inside 7-in casing, using bridge plugs which expand from 4¼ to 7 in. in the set position. A new model operates inside 2½-in. tubing. When fired from the cementing tool, rubber cups which have been collapsed to 2 in. diameter immediately expand to provide an effective bridge and seal in 5-in. hole or pipe.

The tool was specifically designed for spotting small amounts of uncontaminated cement within small intervals, particularly in wells having thin sands whose oil productivity would be damaged if cement was circulated up or down the hole. The 2-in. tool is expected to prove quite useful in permanent-type well completions.

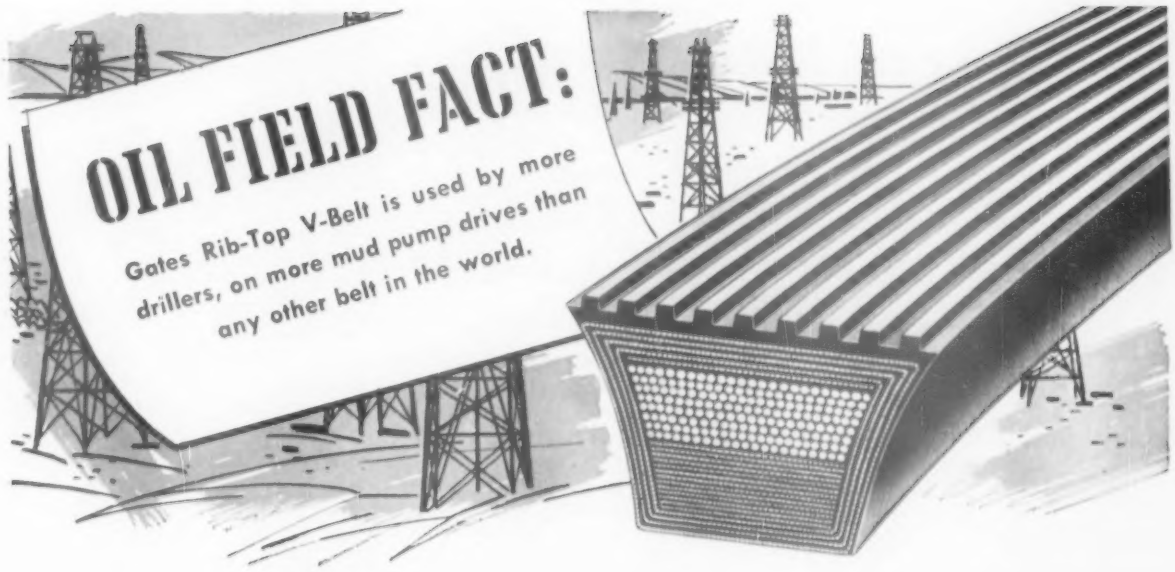
How it works . . . The electrically-fired wire-line cementing tool and bridging tool are consolidated into a single unit, as shown in the accompanying illustration. The unit, some 25-ft. long, is lowered in the hole until the desired depth is reached.

When electrically fired, a slow-burning charge is ignited by a thermite fuse. High pressure created by the large vol-



HOW THE TOOL WORKS

The cementing tool, with the collapsed bridging plug enclosed below the cement load, is run to the desired depth on a wire line (A). When electrically fired, high-pressure gases generated by a slow-burning charge expand the rubber packer to hold the assembly stationary (B). Simultaneously the pressure propels the cement and plug from the tool. Spring-loaded steel blades anchor the plug after it has moved some 12 or 18 in. below the tool.



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DEVELOPED ESPECIALLY FOR MUD PUMP DRIVES

How to make octanes that count

by F. D. BUERSTETTA
Ethyl Corporation, Detroit, Mich.

Manufacture of high-octane gasolines to meet today's and tomorrow's automotive demands is putting increasing pressure on the refiner. Meeting these demands requires that the available hydrocarbon components in the refinery be blended to best advantage to give maximum performance on the road.

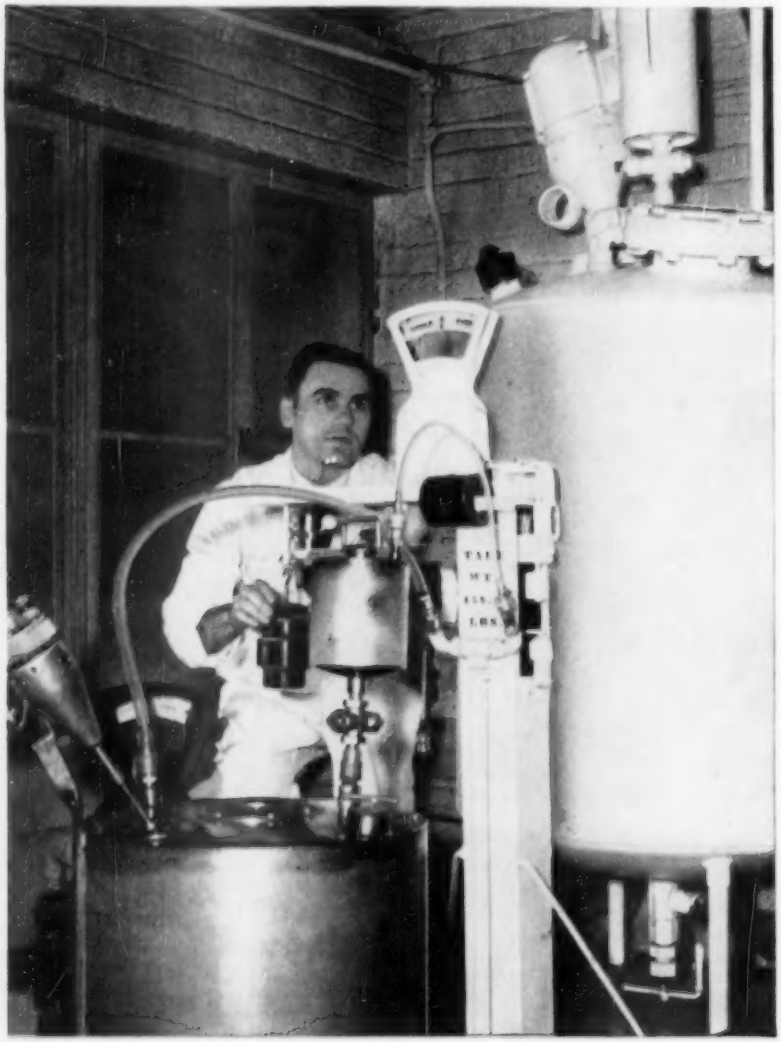
Each octane number at the 100 octane level may cost as much as 15 to 20 cents per barrel. Thus, there is a marked incentive for insuring that each laboratory octane number, obtained at this great expense, provide corresponding antiknock performance in cars on the road.

Hydrocarbon blends studied

As part of a continuing Ethyl Research program to establish the fundamentals of laboratory versus road antiknock quality, a study was conducted not long ago in which the behavior of blends of pure C_7 and C_8 hydrocarbons was examined.

Within this C_7-C_8 range, the four basic hydrocarbon types—olefins, paraffins, naphthenes and aromatics—were blended in varying proportions. Actually, a mixture of iso-octane and *n*-heptane was used as the paraffin constituent to permit maintenance of a constant Research octane number while investigating the effects of tetraethyllead concentration and variations in hydrocarbon-type composition. Toluene, di-isobutylene and methylcyclohexane were selected to represent the aromatics, olefins and naphthenes, respectively. Each of these hydrocarbons was blended in concentrations of 20, 40 and 60 per cent by volume with the proper paraffin mixture, giving nominal Research octane levels of 92, 96 and 100 at each of four tetraethyllead concentrations—0.0, 0.5, 1.5 and 3.0 ml. per gallon.

FIGURE 1. Accurate blending of pure hydrocarbon components at Ethyl Laboratories is the first step in the research program described in these columns.



Each blend was evaluated in laboratory test engines and was then rated in the 9-to-1 compression-ratio engine of a 1955 passenger car equipped with an automatic transmission. Ratings were made by both the Modified Uniontown and Modified Borderline techniques.

The results of that study were reported in detail in "Octane Possibilities with C_7-C_8 Hydrocarbons," copies of which are available on request to Department 31, Ethyl Corporation, 100 Park Ave., New York 17, New York. In general, it was shown that, on the basis of road appreciation (road rating minus Research method rating), highly leaded blends generally outperformed other blends of equivalent R. O. N., especially at high engine speeds.

New data available

Now, a second report in this series entitled "Octanes That Count" is available for your study. This new report compares the various toluene-paraffin blends and di-isobutylene-paraffin blends. Two 1955 passenger cars were used in this study and some interesting data on the effects of vehicle type were obtained.

These cars had V-8 engines of nomi-

FIGURE 2. A test vehicle on the chassis dynamometer engaged in making one of the hundreds of road octane determinations reported in this Ethyl study.

nal 9.0-to-1 and 8.5-to-1 compression ratios and were selected because these engines represent extremes in fuel-rating characteristics.

In order to bracket the maximum octane-number requirement of the two cars used in the study, the test blends were formulated at three different Research octane number levels. Road ratings obtained at these octane-number levels permitted an estimation of the Research quality of a blend which would just satisfy the antiknock requirements of a vehicle at any engine speed. Comparisons of fuel behavior made in this manner eliminate the possibility of obtaining ratings at overly advanced or retarded spark settings. It is believed that a study of this type provides a realistic appraisal of the relative merits of hydrocarbon type and TEL concentration.

Conclusions

Based on the Research octane number of fuels required to give knock-free operation at various engine speeds under normal conditions, the following generalizations can be made:

1. At high engine speeds (3000 RPM):
   a. Toluene-paraffin blends are superior to di-isobutylene-paraffin blends of equivalent hydrocarbon insert concentration and TEL level in both cars tested.
   b. The Research octane number of fuels required to satisfy either car, regardless of hydrocarbon type and concentration, decreases at higher TEL concentrations.

2. At low engine speeds (1000 RPM):
   a. Toluene-paraffin blends and di-isobutylene-paraffin blends are, in general, equally effective in meeting the vehicles' antiknock requirements. Exceptions are the blends with high concentrations of both TEL and hydrocarbon inserts. For these conditions, the toluene-paraffin blends excelled in one car and were slightly inferior in the other.

3. As the concentration of either toluene or di-isobutylene is increased in blends at any given TEL level, the Research octane number of blends required to satisfy one vehicle increased—and the octane number required to satisfy the other vehicle decreased. Thus, highly paraffinic blends showed superior performance in one car and inferior performance in the other used in this test.

How Ethyl Research can help you

At today's high octane levels, the art of blending hydrocarbons has taken on more and more importance. As a service to the oil industry, Ethyl Research has launched a hydrocarbon blending program of its own to complement the intensive effort which the industry is devoting to this problem.

We are now testing many new blends in our laboratories and in high-compression engines on the road. Much of the data from these tests is being interpreted in terms of "road appreciation" to give refiners a better idea of the effectiveness of each blend. Write Department 31, Ethyl Corporation, 100 Park Ave., New York 17, New York, for a copy of "Octanes That Count"—another in the continuing series of reports from the Ethyl Corporation on fuel blending and other studies of vital interest to refiners today.

For further information, just call your Ethyl Representative. He'll be happy to arrange an appointment for you with one of our Technical Representatives.

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ume of gas generated expands the rubber packer to hold the assembly firmly in place. Simultaneously a cast-aluminum disk attached to the bridging plug is ruptured, permitting the cement and plug to be propelled downward. Upon leaving the tool the rubber cups expand to the diameter of the casing (or open hole) and spring-loaded steel blades expand to gouge into the casing (or wall).

Action of the anchoring blades seats the bridging plug after it has moved some 12 to 18 in. into the casing. Pressure firmly expands the rubber cups, which are backed up by hinged aluminum fingers. These effectively seal off the casing or hole and allow the cement to set.

Perforations . . . If the job being undertaken is to set a bottom plug, the cement is driven from the tool onto the bridging plug. If it is a squeeze job the cement is displaced through the perforations and forms a small doughnut around the casing. The peak pressure that can be generated is about 3,500 psi. It lasts only a few seconds. When this period is over the rubber packer contracts permitting the assembly to be pulled from the well.

Additional runs are made with the cementing tool until the desired amount of cement has been placed in the hole or behind the pipe. Each load is displaced by the gas gun, which is reloaded after every run. Volume of cement placed on each trip varies from 2½ sacks in the 5-in. tool to ½ sack in the 2-in. unit.

In most instances only a half-dozen or less runs are made. In one recent job, however, 22 trips were made with a 5-in. tool. It resulted in cementing off a 130-ft. perforated interval in 8⅝-in. casing.

In most work about a 120-lb. per cu. ft. slurry is used. The high pressure generated by the expanding gas produces a dense cement which very quickly sets up. Since the cement contacts at most only a few feet of well fluid, even where no bridging plug is used, little contamination occurs.

As the bridging plus is enclosed within the cementing tool while the unit is being lowered in the well, there is little possibility of the plug being preset by bad pipe. Prolonged spudding in some cases, in an effort to get by a damaged section, failed to unseat or preset the plug.

The combination tool, developed by Hercules Well Servicing Co., has been in use since early this year. Since then bridging plugs have been set in more than 200 wells. How it was used for various jobs is described in following paragraphs.

Intermediate water . . . It proved quite useful in scabbing off an intermediate water zone in a new 9,000-ft. pool at Santa Fe Springs field. Many of the recent wells completed in the 500 to 800-ft. oil section have had high water cuts when the 60 or 70-ft. zone was not isolated. In a case where an attempt was made to squeeze off the zone by usual methods, lower initial production of a few wells indicated some of the oil zone also may have been shut off.

At four wells the tool was used to cement through perforations opposite the top and bottom of the water zone. After 7-in. casing was run and upper water sands cemented off, 24 holes were shot in a 2-ft. interval opposite the bottom of the water sand. The wire-line cementing tool and bridge plug were then run and the gun fired to set the plug 4 or 5 ft. below the perforations. The 5-in. cementing tool was then rerun two or three times to complete the bottom shutoff.

The same procedure then was used to place a top doughnut, except that a bridge plug was not always set. The entire job was completed in six or seven runs in a matter of 7 hours.

To eliminate the need for gun perforating in the last two wells, perforations were made prior to running the 7-in. pipe. One-inch holes were cut about 2 in. apart in an 8-ft. section of two joints. These were then made up in the string so that the perforations would be opposite the top and bottom of the water sand. To eliminate the need for a bridge plug a drillable baffle plate was inserted a few feet below the bottom perforations.

Other uses . . . A number of jobs completed in Wilmington field were either for gas-oil-ratio control or in setting liners. In the first case the gas-bearing interval was squeezed off, somewhat like the bottom plugs were set at Santa Fe Springs. One run usually was sufficient with the 5-in. cementing tool.

The procedure used in completing the Wilmington wells was to set 7-in. casing at the top of the pay. As much oil pay as possible was then drilled, after which the holes were underreamed to 8⅝-in.

Quite often this led to bottom water. In these cases a bottom plug first was set some 20 or 30 ft. below the desired plugged-back depth. Then before the 5-in. liner was run, hole was wire-line cemented until the required amount of cement was in place.

In the Ventura field several jobs were to repair leaky casing. This work involved setting the bridging plug at the desired depth and cementing off the leaks with the wire-line tool. To obtain a good fluid bypass (all work with the tool must be carried out under static conditions), a 4-in. tool was run inside 7-in. casing.

The cement plug then was drilled out. The wire-line plug usually disintegrated as soon as the top anchor was broken, the pieces dropping into the 5½-in. liner. The plug did not slip down when partially drilled out and the result was a milling job on top of the smaller liner.

In high-angle holes there is a tendency for the cement to channel to the low side of the pipe or hole when conventional methods are used. In some cases this has resulted in partially plugged pipe. Where the wire-line method was used, this was avoided by the cement being rapidly propelled into place.

Corrections

The article, "New Inhibitor Safeguards Vapor Spaces Against H_2S Corrosion," page 132, September 24, 1956, issue, carried two typographical errors. On page 132 under **Magnitude of problem,** "whole through the pipe" should read "hole through the pipe." On page 136 under **Vaporization of Diethylamine,** the last sentence refers to "amine vapor in the ammonia gas"; it should read "amine vapor in the annulus gas."

BOOKS

SIGNIFICANCE OF A.S.T.M. TESTS FOR PETROLEUM PRODUCTS. Published by A.S.T.M. 1916 Race Street, Philadelphia 3. 134 pp.

This third edition outlines the significance of the various A.S.T.M. test methods related to petroleum products. Attention is given to their limitations as well as their significance. This volume was prepared by petroleum executives, scientists, engineers, laboratory technicians, and those concerned with the properties of petroleum products and the tests thereof.

Particular properties or characteristics of sampling, selection of test apparatus, methods of test, etc., are discussed in each chapter.

PETROLEUM REFINERY ENGINEER'S HANDBOOK by J. F. Strachan. Published by Philosophical Library, Inc., 15 East Fortieth Street, New York 16. 168 pp. $15.00.

This book under the title "Practical Inspection of Oil Refinery Equipment" was first published in 1947. Since then advances have been made in refining methods, plant design, and new development and modification of processes. This book discusses these changes. In general, however, the technique of plant inspection is substantially unaltered from that described in the first edition.

The most recent methods of inspection and recording developed and used in modern oil refineries are discussed plus the latest experiences of all aspects of plant corrosion and protective measures.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

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U-308	87.5 @ 2400	229.5	308.2	3 13/16 x 4 1/2
U-372	104 @ 2200	288	372	4 3/8 x 4 1/8
U-450	126 @ 2200	323	450.9	4 3/8 x 5
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CHART THAT JOB!

Esso does, and finds that the work goes faster and better. Here's how its done

by Larry Resen
District Editor

HOW to do a better job. That's what's behind the work-simplification round-tables being conducted in research affiliates of Standard Oil Co. (New Jersey).

What is work simplification? In essence it's the application of analytical thinking to routine affairs. Use of the technique means ways can be found to short cut, coordinate, or eliminate activities which otherwise are repetitive, time-consuming, or actually unnecessary.

A work-simplification study was recently completed by the Esso Research Laboratories at Esso Standard Oil Co.'s Baton Rouge refinery. Participants included 65 supervisors and administrative personnel of the laboratory staff and 10 supervisors from the refinery.

Informal sessions were held to discuss work distribution and flow-process charts, human relations, man-machine charts, workplace design, principles of motion economy, work sampling, and records management. While the course was under way, actual plant situations were studied, using work-simplification methods. Approach used and results obtained were recorded as case histories.

Process charts . . . The study makes use of a multicolumn flow-process chart which outlines all of the steps relating to a particular job. The refiner thereby lays out before him all elements of the job and can study them much as he studies the flow of an operating unit. Wall-size blowups of these process charts were made so round-table participants could follow the discussions.

A portion of one of these multicolumn flow-process charts is shown in Fig. 1. This chart traces the workup procedure being followed in a pilot-plant material balance. Symbols are listed in the upper left-hand corner. In this particular case, a technical team plotted the various steps taken to make the balance, including pulling out of data cards, taking samples, recording data and final refiling of information.

The various paper items initially used to begin the balance are shown in the left-hand column. These include operations data sheets, sample cards, and preliminary balance sheets. Additional items enter the flow at appropriate points. The flow sheet outlines the various steps taken relative to each item. Some flow lines cross, combine, or split up, according to the particular setup.

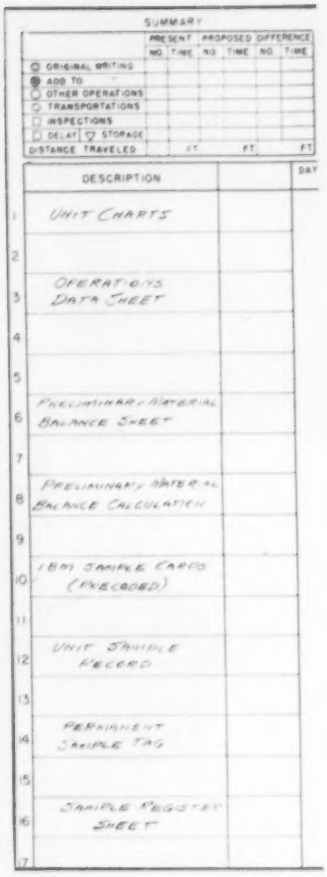
An appropriate symbol is posted on a flow line each time something happens to an item. To illustrate, on the Operations Data Sheet Line (number 3), the initial symbol (two concentric circles) represents the original writing or pulling of the record sheets. The ODS sheets (two in this case) are inspected (a square) and transported (arrow) to the unit office.

At the office they're separated for routing (general operations such as this are indicated by a circle) and then the flow line splits in two directions. One sheet is checked again in the unit office (square) and enters the unit files (triangle). The other sheet is sent to the process data section. It travels by mail car which makes regular rounds. Hence, there is a delay involved, and the delay symbol (the letter "D") is superimposed on transportation-arrow.

The sheet is next checked (square) at the process station, where the data are averaged. A crosshatched circle indicates additions have been made to the item. The averages are next posted on the preliminary data sheet. Since this sheet is also undergoing a process flow, the ODS line jogs to meet this line, immediately below it on the flow sheet. The ODS averages are posted on the PDS and a crosshatched circle at the intersection of the two flow lines indicates this operation.

The ODS line continues through another jog where it is entered on the detailed material-balance operating data sheet. A concentric circle shows that this latter sheet is now entering the process flow for the first time. A new flow line is now needed for this sheet. Meanwhile, the ODS sheet terminates in the permanent files (triangle).

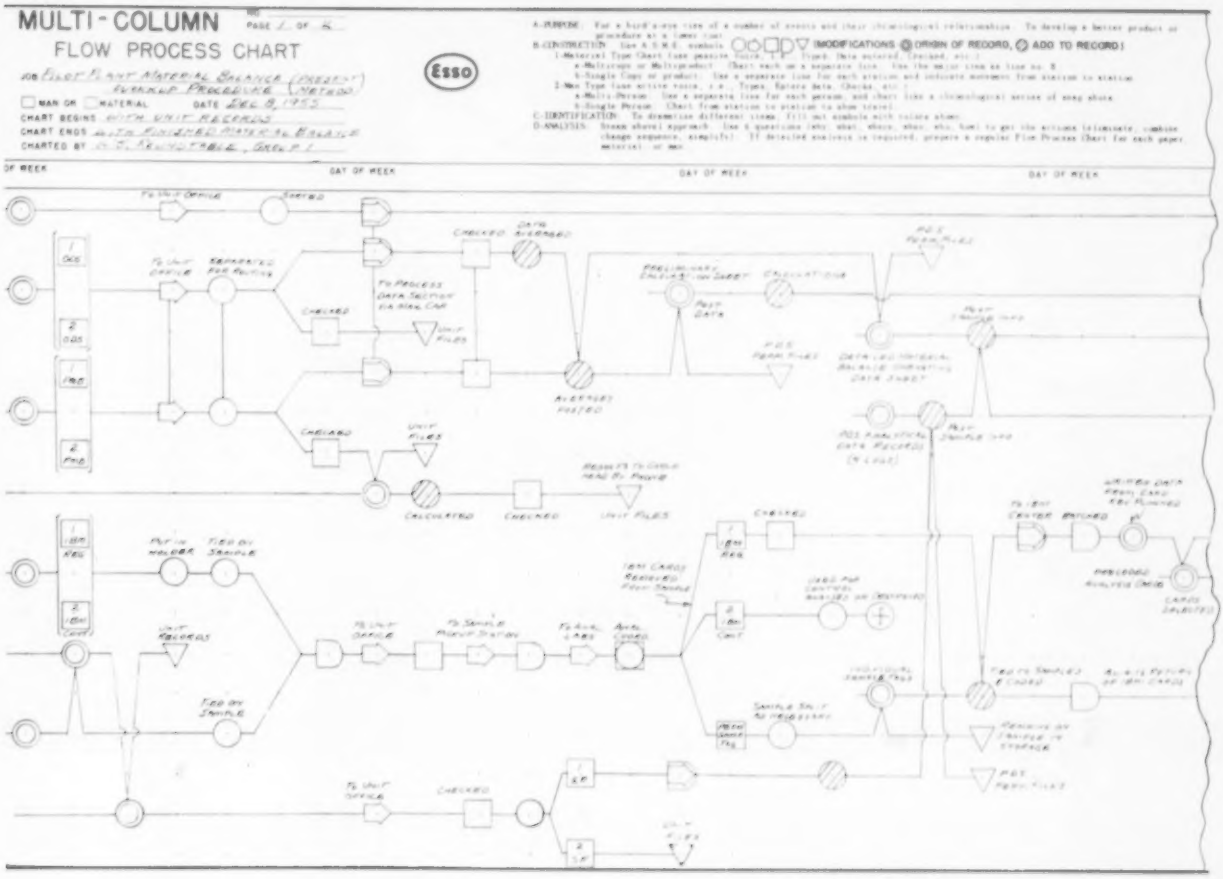
There are several places along the ODS flow line and the preliminary material-balance-sheet flow lines, immediately below it, where the same function takes place. For instance, they are transported together to the unit office and are then routed from there. These mutual operations are shown by a vertical line tying the two functions together.



In the construction of the flow chart, compilation of basic data is a critical part of the program. To avoid the "stop-watch" approach, the Esso program stressed the value of statistical sampling techniques for gathering data. In many studies random observations were made several times per day, and when enough data had been accumulated they were then assembled to make a simulated but fully accurate process flow chart. In order to come up with objective results, the people involved in doing the work were kept fully informed, as were various union officials. People were urged to perform their tasks normally so a truly representative picture could be drawn. At the same time they were acquainted with the program's objective: namely, an effort to increase efficiency and thereby reduce over-all costs.

Analysis . . . Once the flow chart has been plotted, the next big step is the analysis. The basic idea is to eliminate

REFINING



FLOW-PROCESS CHART used by Esso's Baton Rouge refinery to expedite work. Fig. 1.

as many symbols as possible. Since each represents a form of action, the fewer symbols, the less action, delay, or work which will be involved in performing the job. In analyzing the flow, each line is traced through and a pause is made at each symbol to ask six questions: Why? What? When? Where? Who? How? The answers to these will determine the subsequent action to be taken: Eliminate. Combine. Change Sequence. Simplify.

How this might work may be seen by referring to the process chart and the ODS flow line as well as the Preliminary Material Balance Sheet flow line. Initially, there are four common steps on each flow line: original writing, inspection, transportation, and separation for routing. Which of these four might be eliminated? Conceivably the separation for routing step could be combined with the inspection step.

Hence, with a change of sequence, a 25 per cent reduction in handling is immediately evident in the first few steps. Both flow lines split and continue through the unit office to the process data section. And both are delayed in transportation while waiting for the mail car to make its rounds. If in analysis it was determined that this delay was holding up process-data-section work needlessly, it might prove desirable to provide special tranportation and eliminate the delay entirely.

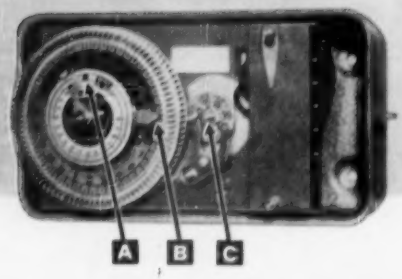
When the flow lines split, the sheets are checked and filed as noted above. In analyzing the unit office files, it might be found that this is a repetitious step which also could be eliminated. Thus, another handling step would be dropped. Actually, this would be two fewer, since if nothing were filed in the unit office, it would also eliminate the checking step there.

Looking at lines 10, 12, and 14 (all relating to sample cards) there are several delays indicated as well as numerous transportation steps. Again, depending on the seriousness of the delays, it might be possible to eliminate some of them by providing special transportation or even combine some of the transportation steps.

It'll be seen that in all of the process chart flow lines, both basic and complicated steps are indicated. Thus, filing is a basic and simple procedure while making calculations can become quite involved. While it is not practical to eliminate all of these particular steps on a chart the graphic layout highlights those steps which could be cut out or changed. For instance, the flow lines would show where unnecessary filing is being done. Or they could bring to light several calculation steps which can be combined. A change in sequence of preliminary calculations, as an example, could possibly avoid repetition later on when final calculations are being made. Hence, these possibilities account for the fine-tooth-comb approach in plotting a chart.

The charts can be prepared for practically any refinery function, from ordering supplies to repair of units. An analysis of the former may show where delays are actually slowing down final delivery of goods. The latter analysis may uncover delays in getting tools to a job site; delays which are cutting into productive job time. The charts present a very graphic picture of an entire procedure even though it may be fairly complicated. By using these charts, a supervisor can quickly study the entire procedure and visualize opportunities for work simplification.

SET IT—LOCK IT—FORGET IT



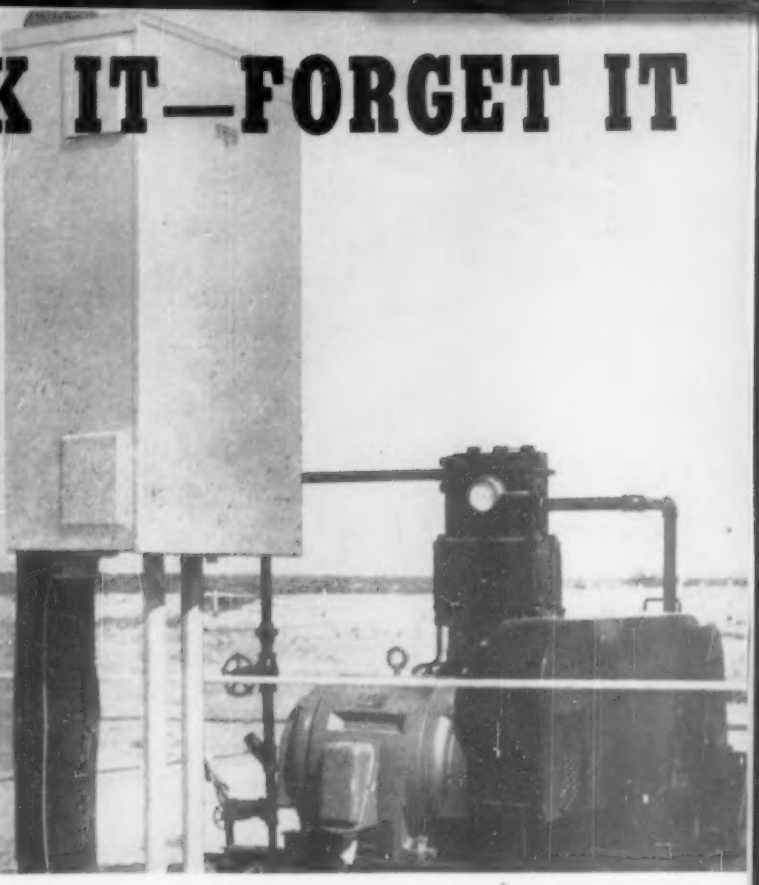
NEW CUTLER-HAMMER SUPERTIMER

This advanced-designed, rugged program timer is the heart of automatic pumping.

A Sets the precise restarting time delay from zero to 180 seconds. This is exclusive with the Supertimer—random starts or coincidental starts of even two pumps are impossible.

B Sets the daily pumping schedule—pull a tab for each fifteen minutes of pumping, space them through the daily 24 hour period as desired.

C Sets the weekly pumping schedule—1, 2, 3, 4, 5, 6 or 7 days per week as desired.



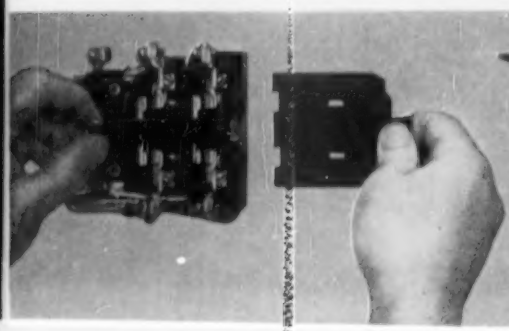
Cutler-Hammer Three-Star Oil Well Pumping Control Brings Full Automation to Oil Well Pumping

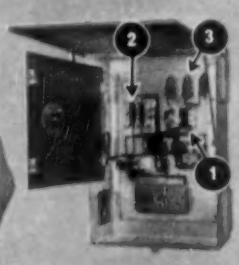
Nothing is left to chance . . . Cutler-Hammer Three-Star Oil Well Pumping Control is so completely automatic and so completely dependable, it can be relied upon to pump your wells indefinitely on a pre-set schedule without attention as far as the electrical equipment is concerned. Astonishing? Yes. Exaggerated? No. The Cutler-Hammer Three-Star Oil Well Pumping Control will out-perform, out-protect, out-last, and serve better than all others. This is *automation* in action. You pre-set the pumping schedule and the control does the rest. It starts, stops, restarts and cycles *indefinitely* according to the pre-set Supertimer. It provides complete protection with 3 coil overload relays, advanced-designed lightning arresters and full dependability of contactor performance. And C-H three-star control stays on the job. Blistering heat, ice, bugs or dust hold no terror for this control. This control has *everything* particularly the engineered dependability so vital in any automation . . . nothing is left to chance. For the finest, insist on Cutler-Hammer.

Your nearby Authorized Cutler-Hammer Distributor is stocked and ready to serve you. Order from him today. CUTLER-HAMMER, Inc., 1453 St. Paul Ave., Milwaukee 1, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

CUTLER-HAMMER
MOTOR CONTROL
C-H

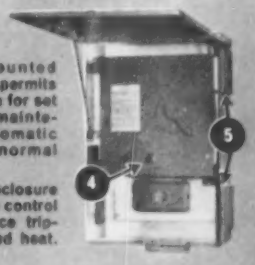
DUST-SAFE CONTACTS—Dust, the greatest menace to oil field equipment, can't settle on the vertical contacts of the Cutler-Hammer Three-Star Oil Well Pumping Control and interrupt service. C-H vertical contacts provide cleaner, cooler, smoother operation and eliminate contact maintenance when properly rated.





PLUS Many Important Features of Design

1. Contactor type disconnect switch with visible vertical dust-safe contacts.
2. Spring type fuse receiver with constant contact pressure fuse clips.
3. Advanced-designed lightning arresters—safety plus for electrical equipment and personnel.
4. Inner door mounted selector switch permits manual operation for set up and pump maintenance and automatic operation for normal pumping.
5. Chimney draft enclosure design keeps the control cool—no nuisance tripping from trapped heat.



JOB IMPROVEMENT FOR THE PROCESS FOREMAN—69

How Tower Pressure Can Be Controlled

THE function of the isobutane tower is to produce an isobutane overhead product which contains practically no normal butane and a normal butane bottoms product relatively free of isobutanes.

The first set of conditions shown *(see Fig. 10, The Oil and Gas Journal, October 29, page 125)* indicate considerable contamination of both the overhead and bottoms products. This is due to a low temperature gradient (18° F.) caused by too low a reflux rate.

The second set of conditions reflect tower operation after cleaning of the overhead condensers. A much higher reflux rate was used (46,400 vs. 24,800 bbl. per day). The tower top temperature went down and the bottoms temperature increased, thus providing a larger temperature gradient (24° vs. 18° F.).

The effect on product purity is very marked. The purity of both the overhead and bottoms products increased, the isobutane purity from 71.7 to 92.0 per cent and the normal butane purity from 80.9 to 88.1 per cent.

Proper temperature . . . The maintenance of proper temperature gradients in distillation processes is very important. The major purpose of the refinery is to produce specification products from crude oil. These products are segregated by distillation and the extent to which segregation of stocks is to be carried depends largely on attaining maximum temperature gradients in the various fractionating operations.

Fractionating Tower Operation

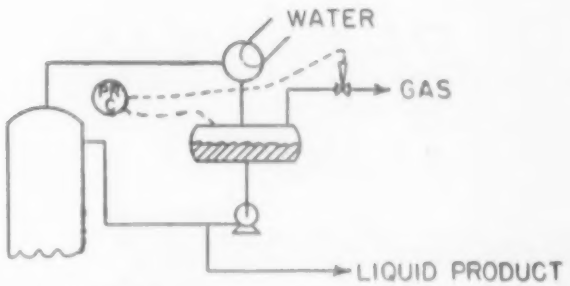
A fractionating tower operating with rapid fluctuations in pressure, temperatures, and flow rates will barely produce fractionated products. These fluctuations cause momentary unbalances which often result in contamination of the products. Exact control of operating conditions on distillation towers is, therefore, essential if effective control of product purity is to be maintained.

Basically, four types of control systems are used in distillation processes. The purpose of these systems is to provide: (1) pressure control, (2) temperature control, (3) flow control, and (4) level control.

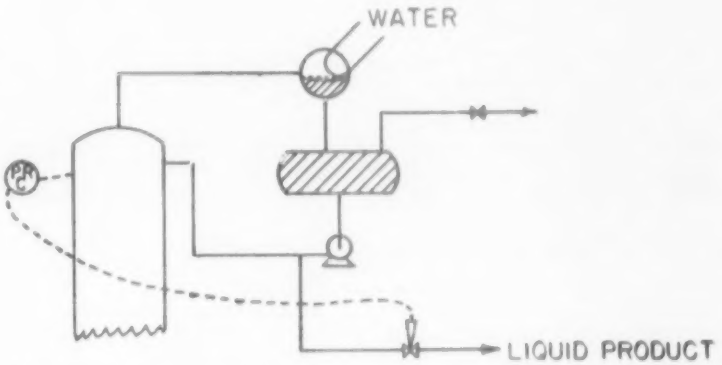
Pressure control . . . Tower pressure can be controlled many ways. The more common of these are:

1. Removal of a portion of the overhead product as gas—a backpressure regulator is installed in the gas line. Increased pressure bleeds gas out of the tower, thus reducing pressure. Fig. 11 illustrates this point.

2. Total condensation of the overhead product (flooded condenser operation) — backpressure regulator is installed in overhead product line. Increased pressure opens control valve, uncovering tubes in the condenser bundle and dropping pressure. See Fig. 12.



OVERHEAD PRODUCT is removed as gas when backpressure regulator is installed in the gas line, thus reducing pressure. Fig. 11.



FLOODED CONDENSER causes total condensation of the overhead product. Fig. 12.

This material is taken from "Fundamentals of Refining," operating manual of Magnolia Petroleum Co., refining division, Beaumont, Tex.

Here's how you can get

MORE EFFICIENT OIL RECOVERY from your flooding operations:

INSIST upon these standards for your flooding medium

1. **Chemical stability**
2. **Oil content zero**
3. **Iron content 0.2 parts per million**
4. **Turbidity 1 part per million**

Most operators agree that these standards for the flooding medium (water, produced brine, or both) are necessary for minimizing clogging of the input formation. INFILCO *complete* treating plants, which include the highly efficient ACCELATOR® Stabilizer, provide water within the specified limits. Closed systems, or other types of partial treatment, seldom meet these exacting requirements.

Existing INFILCO installations are treating over 500,000 barrels per day with three-way economy: lower first cost; lowest maintenance and low, low chemical costs. INFILCO engineers have over 30 years experience in designing *complete* flooding water treatment plants. Be sure you are getting maximum oil recovery by consulting your nearby INFILCO engineer. If you prefer, write for complete information.

Typical INFILCO flooding water treatment plant includes: Forced Draft Aerators; "ACCELATOR" Treating Plants; Chemical Feeders and INFILCO Pressure Filter Plant.

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THE **ONE** COMPANY OFFERING EQUIPMENT FOR **ALL** TYPES OF WATER AND WASTE TREATMENT

5618 (OG)

by D. K. Taylor

How to Desulfurize Natural Gas—1

. . . the iron sponge (dry box) method

IT is entirely economic and feasible to remove reasonable quantities of H_2S by the iron oxide method if care is used in design. The tower should be installed on legs with bottom dump outlets and with the proper tools for easy charging and discharging of material. The economics of the process are helped tremendously if it is possible to have present a few tenths of a per cent of oxygen.

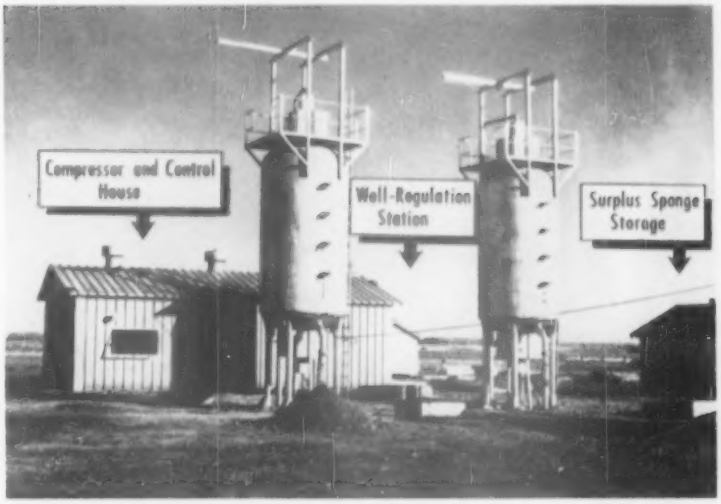
Installation of this method is not recommended if more than 8 or 10 tons of recoverable sulfur were available per day. At this level, or higher, recovery of the sulfur would be economical.

It is felt also that at levels of over 1,000 grains, the normal sponge life would be so short that it would make difficult the economic balance required. It is suggested that a liquid plant be installed in such a case that would take out 90 to 92 per cent of the H_2S and then clean up with oxide.

Data collected . . . Some 10 years ago, Connelly, Inc., undertook to collect data on purification of natural gas using Fe_2O_3 manufactured in a highly hydrated form.

One purifier of this type was 7 ft. in diameter and of such height that 385 cu. ft. of oxide could be installed at an average of 7.1 lb. of Fe_2O_3, dry basis, per cubic foot. This meant that a total of 2,730 lb. of Fe_2O_3 was present. The gas was passed downflow, having an inlet H_2S averaging 19.8 grains per hundred cubic feet, and 7,088 lb. of sulfur was removed before a stain was produced on the outlet. Approximately 244 per cent, by weight, of the Fe_2O_3 was removed in pounds of sulfur.

Author is western division manager, Connelly, Inc. Paper presented at Gas Conditioning conference, University of Oklahoma.



TYPICAL INSTALLATION of two 7-ft. diameter towers at Brooks, Alta., plant of Canadian Western Natural Gas Co. Approximately 244 per cent, by weight, of Fe_2O_3 was removed in pounds of sulfur from this setup.

High-pressure purification . . . The differential pressure across the purifier, at the end of the fouling period, was approximately 30-in. water column, or a little over 1 psi. This factor is the basis of our classification of this type of purification as high-pressure purification — really high-differential-pressure purification.

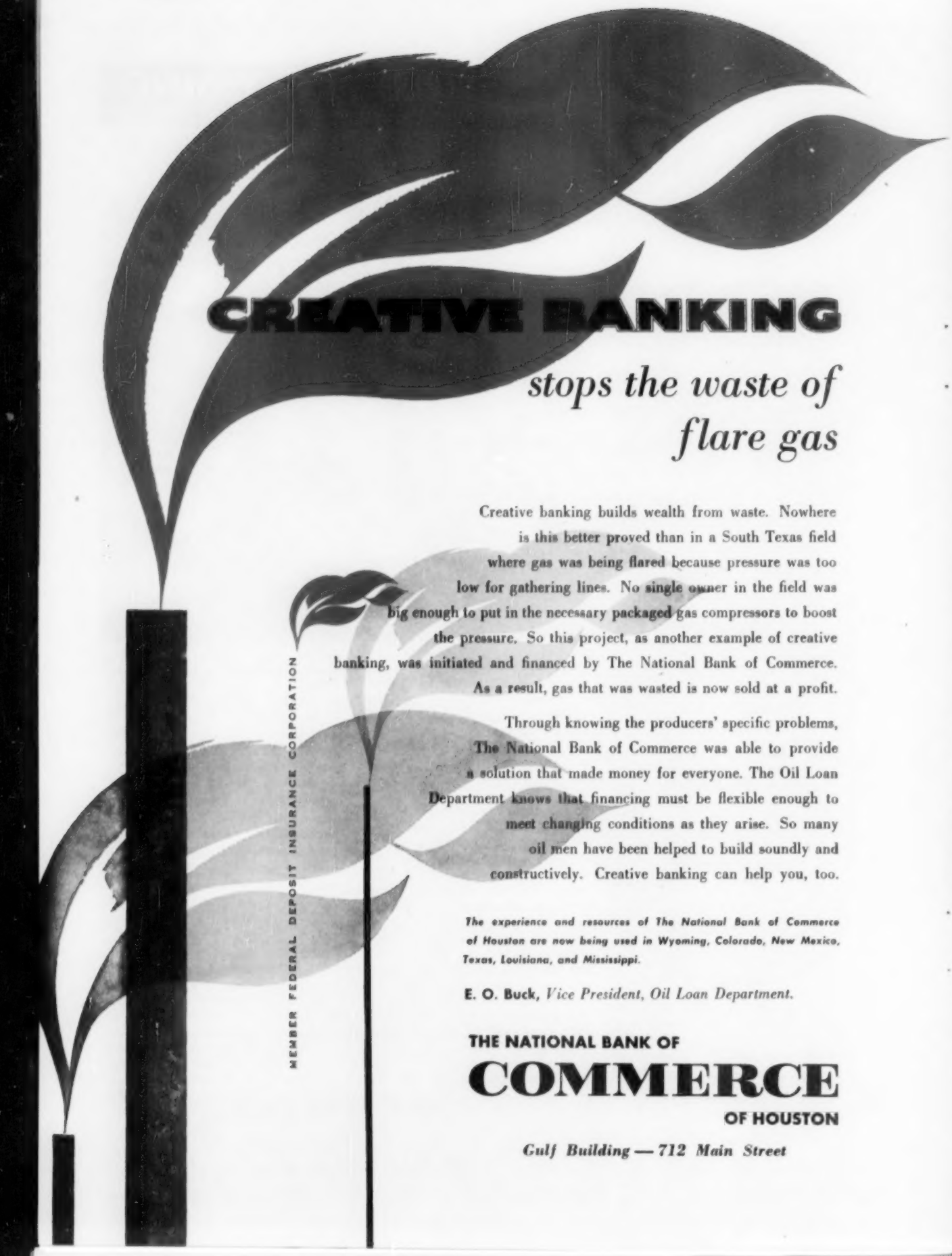
Actually this purifier only operated at about 10 psi., but the high-pressure drop allowable, together with the fact that careful observation of operating conditions was maintained, gave us a good deal of the detail data as to rate of reaction, and other factors which we had been questioning for several years.

The results were so satisfactory that Birmingham Gas Co. built several more purifiers of this type. A larger purifier was installed and this time an 11-ft. diameter by 10-ft. thick bed of sponge was used. This purifier was rated at 250,000 cu. ft. per hour of 20 grains H_2S gas.

In November 1946, they had absorbed 14,965 lb. of sulfur and had passed 1,286,556,000 cu. ft. before having a stain.

Regeneration in place . . . Both of these jobs were utilizing the revivification-in-place technique which had been discovered years earlier in low-pressure purification. This required that we take advantage of the reaction of oxygen with Fe_2S_3 to reform Fe_2O_3 with the liberation of free solid sulfur in the mass.

However, this second type of purifier for Birmingham gas was put up hastily, and there was no time to install an air compressor, to furnish the small (3 per cent) quantity of air required for this second reaction, and during the first use of this purifier, the only air used was in slugs furnished by a portable compressor whenever a stain appeared on the outlet of the purifier.



CREATIVE BANKING

stops the waste of flare gas

Creative banking builds wealth from waste. Nowhere is this better proved than in a South Texas field where gas was being flared because pressure was too low for gathering lines. No single owner in the field was big enough to put in the necessary packaged gas compressors to boost the pressure. So this project, as another example of creative banking, was initiated and financed by The National Bank of Commerce. As a result, gas that was wasted is now sold at a profit.

Through knowing the producers' specific problems, The National Bank of Commerce was able to provide a solution that made money for everyone. The Oil Loan Department knows that financing must be flexible enough to meet changing conditions as they arise. So many oil men have been helped to build soundly and constructively. Creative banking can help you, too.

The experience and resources of The National Bank of Commerce of Houston are now being used in Wyoming, Colorado, New Mexico, Texas, Louisiana, and Mississippi.

E. O. Buck, *Vice President, Oil Loan Department.*

THE NATIONAL BANK OF

COMMERCE

OF HOUSTON

Gulf Building — 712 Main Street

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

by W. L. Nelson
Technical Editor

COST-imating

20. Piping Costs

ALTHOUGH the cost of piping may be computed in detail by tabulating the various lines, fittings, valves, etc., the ordinary cost estimator is unable to visualize the entire piping system and he thus introduces error rather than accuracy. Only the smallest and simplest piping systems may be handled accurately by the detailed method, unless time is available to lay out each part of the piping system. Accordingly, most estimators rely on percentages of the total plant cost or the cost of the major process equipment, such as those indicated in Table 1. Most accurate percentage, according to Table 1, is the combined cost of installed piping and process equipment. This amounts to about 52.5 per cent of the total cost of the plant (Item 36 of Cost-imating No. 4, The Oil and Gas Journal, January 2, 1956, page 120).

Detailed estimates are not recommended, not alone because of the time consumed, but because of the great skill required in visualizing or recalling numerous crossovers, emergency lines, auxiliary piping, etc., let alone the selection of the proper or most economical sizes. However, such a method is applied by obtaining the cost of all pipe, fittings, valves, etc., from Cost-imating issues[1] or similar sources. Labor and installation costs may then be obtained by formulas similar to that of Schrader:[7]

$$H = 0.23\ L + 3.7\ (0.6\ D + 0.7)\ F$$

in which:

H = man-hours for fabrication and installation
L = length of pipe, ft.
D = diameter of pipe, in.
F = a factor for each fitting:

Elbows	1.0
Valves, etc.	1.3
Tees	1.5
Crosses	2.0
Flanges	0.1
Miscellaneous	1.0

The factors (F) for all the fittings are summed, but if three or more flange fittings are set face to face, the values of F are halved. Finally, the man-hours of labor is multiplied by the following factors:

1. No factor—new construction, normal working conditions with few obstructions, and cutting and fitting done at site.
2. Add 15 per cent—scaffolding or ladder required.
3. Add 15 per cent—cramped restricted working space.
4. Add 15 per cent—piping is connected into an existing system.
5. Add 10 per cent—cutting, threading, etc., handled away from job.
6. Add 8 per cent—stainless steel.
7. Less 10 per cent—entirely wrought steel pipe and fittings.

Finally, the cost of supports is about 10 per cent of the total piping cost.

COST INDEXES (1946 = 100) OF PIPE, VALVES AND FITTINGS[1]

	Boiler tubes	Pipe	Castings	Valves and fittings	Labor	Nelson index[2]
1946	100	100	100	100	100	100.0
1947	115	120			113	117.0
1948	135	141	145	126	128	132.5
1949	141	152	151	133	137	139.7
1950	150	160	153	136	144	146.2
1951	163	169	167		152	157.2
1952	169	179	168	191	163	163.6
1953	188	186	177	193	174	173.5
1954	199	195	181	197	183	179.8
1955	211	204	185	209	190	184.2

References

1. Nelson, W. L., Pipe and Tubing, The Oil and Gas Journal, August 4, 1949, p. 65, and Fittings and Flanges, September 1, 1949, p. 71.
2. Nelson, W. L., The Nelson Refinery Construction Cost Index, The Oil and Gas Journal, July 7, 1952, p. 105. (The index also appears in the first issue each month, and in addition indexes for many items of equipment are published in the first issues of January, April, July, and October.)
3. Lang, H. S., Chem. Eng., October 1947, p. 117.
4. Harris, J. McA., Chem. Eng. Progress, 44, 333 (1948).
5. Chilton, C. H., Chem. Eng., June 1949, p. 97.
6. Happel, Aries and Borns, Chem. Eng., October 1946, p. 99.
7. Schrader, R. J., Chem. Eng., January 1947, p. 109.

TABLE 1—RELATIVE COSTS OF PIPING IN FLUID TYPE OF PLANTS

	Total cost	Piping and major process equipment, per cent of total cost*	Piping,* percentage of: Total plant cost*	Piping,* percentage of: Major equipment cost*
Fluid type plant[3]	$100,000	50.0	8.7	21
Fluid type plant[3]	150,000	52.4	9.4	22
Debutanizer	200,000	56.0	19.8	55
Fluid type plant[3]	400,000	50.5	14.1	39
Fluid type plant[3]	400,000	43.6	8.6	25
Fluid type plant[3]	500,000	53.2	18.0	51
Catalytic cracking	800,000	43.0	17.9	52
Thermal cracking	800,000	64.8	15.2	31
Gas-cracking plant	1,000,000	58.0	17.4	43
Gasoline plant (compression)	1,200,000	58.0	17.7	35
Ethylene	2,000,000	56.0	17.9	46
Fluid type plant[3]	2,000,000	53.6	21.3	66
Gasoline plant	2,400,000	44.0	15.6	43
Gasoline plant	5,600,000	54.0	19.2	46
Gasoline plant	5,600,000	52.0	17.4	39
Gasoline plant	6,100,000	58.0	20.2	41
Refinery, modern	6,000,000	51.6	19.6	61
Refinery, modern	7,400,000	50.0	21.0	53
Cost-imating No. 4†		47.3	15.3	48
Harris[4]				43-55
Chilton[5]				30-60
Happel[6]				20-50
Average		52.5	16.6	43
Range, above avg. (per cent)		23	28	54
Range, below avg. (per cent)		18	47	53

*Material and labor. †The Oil and Gas Journal, January 2, 1956, p. 120.

X MAYARI RODS Going Into 9th Year in 4000-footer near Pratt, Kansas

Talk about economical service! At a well of Lion Oil Company, Division of Monsanto Chemical Company, in South-Central Kansas, Bethlehem ¾-in. X Mayari Sucker Rods are going into their ninth year of pumping duty. And in all that time, rod replacement in the 4340-ft string has been low, despite a considerable volume of hydrogen-sulphide gas.

The well, located on the John V Lease in the Chitwood Field, is producing 286 bbl of water and 10 bbl of API 40-gravity oil daily, from Viola Lime formation. The pumping unit, a Bethlehem 99DTA-14, is operating with a 54-in. stroke at the rate of 22 spm.

Bethlehem's X Mayari Sucker Rod is excellent for heavy-pumping duty. It is carefully made of a special grade of nickel-chromium steel, and is normalized to obtain uniform mechanical properties. The rod comes with carburized, hardened-and-ground A4615 steel couplings.

FULL LINE OF RODS

To enable operators to meet virtually every pumping condition, and to help combat corrosion, Bethlehem also produces three other types of carbon and alloy rods, plus a complete range of rod accessories. For information, call your Bethlehem sucker-rod distributor. Or write to the nearest Bethlehem sales office.

BETHLEHEM STEEL COMPANY
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PAINTING STEEL—8

Here Are Specifications for Painting Tanks

by J. O. Jackson* and Joseph Bigos†

COAL-TAR mastic coatings and asphalt varnish are covered by the part of Paint System No. 9 which is summarized in Table 5. The major difficulty in protecting exteriors of tank bottoms is damage done to the coating by welding. Specifications permit welding in place after coating. No method satisfactorily protects the joints and, if for no other reason, cathodic protection may be required.

Tank interiors . . . Interiors of corrosive-product tanks are protected by various methods. When corrosion occurs from contact with separated water, hot coal-tar enamel may be applied to the bottom and several feet up the shell. This enamel should be applied in accordance with the requirements for hot coal-tar primer and enamel in Paint System No. 9, "Bituminous Coatings," but an unplasticized enamel known to be satisfactory for this service must be used rather than high-penetration enamel of the A.W.W.A. grades.

Gunite or reinforced concrete may be used for lining tanks in severe service. The roof and steel in the vapor space is more rapidly attacked than the shell. Lining—because of its high cost—is often restricted to the roof and several top feet of the shell.

Considerable success has been reported with the use of vinylidene chloride—acrylonitrile copolymer solution coatings (Saran) in lining high-octane-gasoline storage tanks. Past experience with organic coatings for linings in tanks for sour-crude service has been disappointing but new developments in this field should result in coatings that will economically protect the steel from interior corrosion.

Storage tanks . . . Liquefied-gas storage tanks—cylinders, spheres, spheroids—and any tank in which the temperature of the contents should be kept low should be painted white. Structural steelwork, stairs, railings, guy rods, stiffeners, and accessories are expensive to paint and a durable paint system is required. Aluminum, black, gray, dark green, etc., are logical finish colors for these components even when the remainder of the tank is white.

Table 6 summarizes the painting recommendations for tanks in normal refinery exposures. If the tank is used to store corrosive chemicals or is exposed to corrosive chemicals, or high humidity and condensation, then paint the tank with a suitable system as outlined for process equipment.[1]

*Pittsburgh-Des Moines Steel Co., Pittsburgh. †Senior Fellow, Mellon Institute of Industrial Research. Paper presented at A.P.I. Refinery Division meeting, Montreal, 1956.

References

1. Bigos, Joseph, Vol. 1, "Good Painting Practice," and Vol. 2, "Systems and Specifications," Steel Structures Painting Manual published by Steel Structures Painting Council, Pittsburgh (1954 and 1955).

2. Steel Structures Painting Manual.

TABLE 5—STEEL IN CONTACT WITH SOIL[2]

Type of steel and coating—
Structural steel that is buried in noncorrosive soils or requires little protection. Examples: Pipelines or structural steel buried in very high resistivity soils, small storage tanks not in contact with cinders, sewage or ground acids, heavy cast-iron mains, bottoms of tanks resting on dry soil, sand pads, or concrete—Use TT-V-51a, asphalt varnish, in S.S.P.C.-PS 7-55T, "One-Coat Shop Paint Systems for Structural Steel."
Structural steel that is buried in slightly corrosive soils or requires short term or moderate protection. Examples: Pipelines or structural steel buried in medium to high-resistivity soils, small storage tanks in contact with slightly corrosive soil or backfills.—Use CA-50, coal-tar mastic, in S.S.P.C.-PS 9-55T, "Bituminous Coatings."
Structural steel that is buried in highly corrosive soils, river bottoms, marshland, tidal regions, or which requires very good, long-lasting protection. Examples: Pipelines or structurals in low-resistivity soils, acid soil or decomposing organic matter, high-pressure buried tanks, thin metal, steel partially buried and exposed at ground line—Use coal-tar primer and enamel of S.S.P.C.-PS 9-55T, "Bituminous Coatings."

TABLE 6—PAINTING RECOMMENDATIONS FOR TANKS

Paint System No. 1

Surface preparation—Hand cleaning, power-tool cleaning.
Pretreatment—None required.
Primer—Red lead, zinc chromate, or zinc dust—zinc oxide with oil base or mixed oil and alkyd vehicle. See S.S.P.C. Paint System No. 1 in Table 3.
Intermediate coat—Same as primer, but tinted.

Paint System No. 2

Surface preparation—Blast cleaning, pickling.
Pretreatment—None required.
Primer—Red lead, zinc chromate, or zinc dust—zinc oxide with alkyd vehicle. See S.S.P.C. Paint System No. 2 in Table 4.
Intermediate coat—Same as primer, but tinted.

Use finishes listed below with either system above:

Finish coat(s)—High breathing-loss tanks—
Roof—Cone roof, variable vapor space, diaphragm. Use: chalking white alkyd S.S.P.C. Paint 104-55T, Type 1.
Shell—Cone roof, old floating-roof tanks with high losses. Cylinders, spheres, spheroids for storing liquefied gases. Use chalking white alkyd S.S.P.C. Paint 104-55T, Type 1.

Finish coat(s)—Low breathing-loss tanks—
Roof—Floating roof, pontoon roof. Use: aluminum alkyd S.S.P.C. Paint 101-55T.
Shell—New floating-roof tanks, variable vapor-space tanks. Cylinders, spheres, spheroids, and oil tanks in which temperature of contents is not critical. Use aluminum alkyd S.S.P.C. Paint 101-55T.

Structurals, stairs, railings, columns, etc., Use:
Aluminum alkyd Paint 101-55T;
Black alkyd S.S.P.C. Paint 102-55T;
Gray alkyd S.S.P.C. Paint 104-55T, Type 2;
Green alkyd S.S.P.C. Paint 104-55T, Type 3 or 4; or
Any finish paint listed in S.S.P.C. Paint System No. 1 or 2.

Note: Oil-base finish paints are listed in Paint System No. 1[1] and may be used on alkyd paints in Paint System No. 2 if desired.

Oil-base primers in Paint System No. 1 may be used with alkyd finish paints in Paint System No. 1 or 2, if desired.

Wetting-oil pretreatment in System No. 1 and wash primer or hot-phosphate pretreatment in System No. 2 are often advantageous.

Two finish coats are preferred.

You'll do better with

H C Smith ROCK BITS

-every bit
~~as good as~~
the best

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Among the

Drilling Contractors

Midland Company Enters Louisiana Offshore Play

OTIS GOODE

LEO DEAN

Llano Drilling Co., Midland, Tex., is joining the list of inland contractors getting their feet wet in Louisiana's offshore drilling operations.

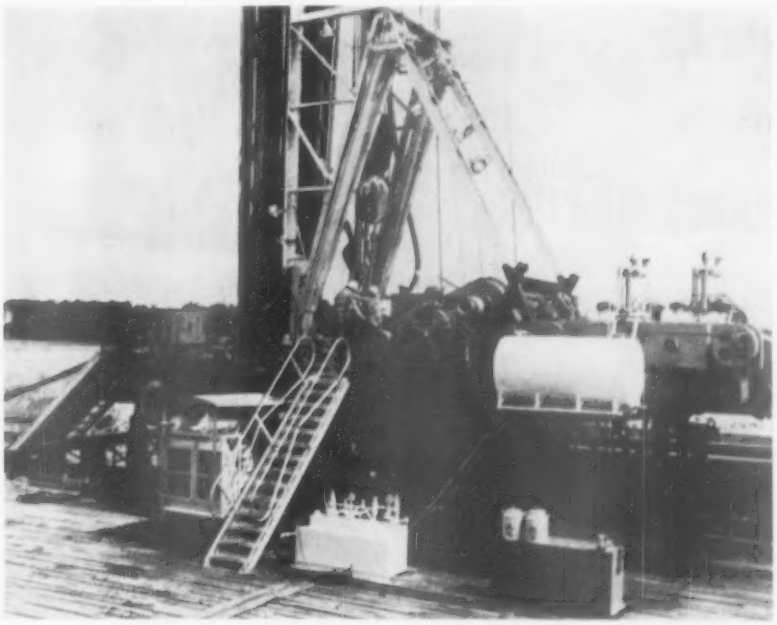
It will drill Forest Oil Corp.'s deep wildcat test in Block 140, Ship Shoal area, about 40 miles off Terrebonne Parish. It will use the new drilling tender "Clayton G. Dorn." Location is in the block to the north of Gulf Refining Co.'s multiple-pay Block 154 field, opened in 1955.

Llano recently announced the transfer of Leo Dean, its drilling superintendent in the West Texas-New Mexico district, to South Louisiana, where he will be in charge of the company's offshore operations. Dean headquarters at Morgan City, a central coastal operating point, where the company has established offices.

The company will continue to operate five rotary rigs in the Permian basin region, with Otis Goode, of Odessa, succeeding Dean as drilling superintendent in that district.

Security Drilling Co. is on a new 4,500-ft. wildcat test in Bee County, South Texas. It is a joint operation for its own account and Phillip B. Berry at 1 McKinney, in the L. C. Randolph Survey.

Larco Drilling Co., Jackson, has contracted for three additional South Mississippi wildcat tests, one in Forrest County, another in Franklin County, and the third in Wilkinson County. The first is a 10,000-ft. operation for Como Drilling Co., Dave Gammill, and Calvin R. Allen at 1 Newton Naval Stores, in 14-2n-12w, about 5 miles north of Brooklyn and about 10 miles north of Maxie field. The second is



GETTING A TRYOUT on a 10,000-ft. hole in Harris County, Texas, Gulf Coast, prior to shipment to South America is this new slim-hole rig owned by John W. Mecom, of Houston. The Cardwell J-450 draw works and mast are mounted on twin trailers. Power to the draw works is supplied by two G.M. Detroit Diesel Series 71 twin engines. The rotary table is driven by another Detroit Diesel twin which may be compounded to the draw works to provide extra power when needed.

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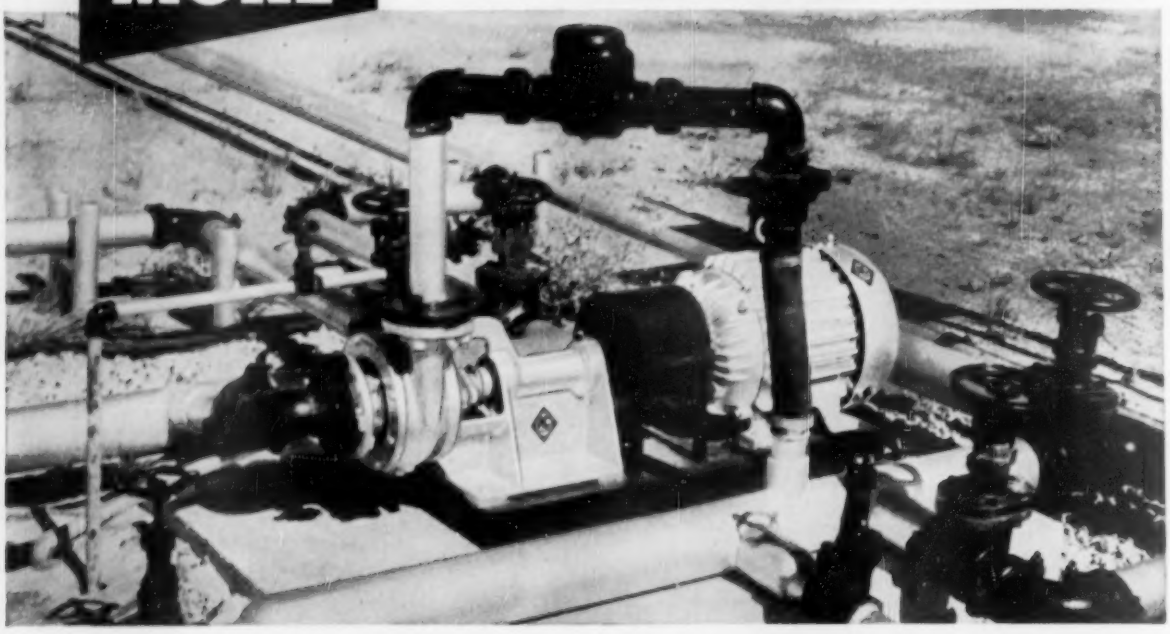
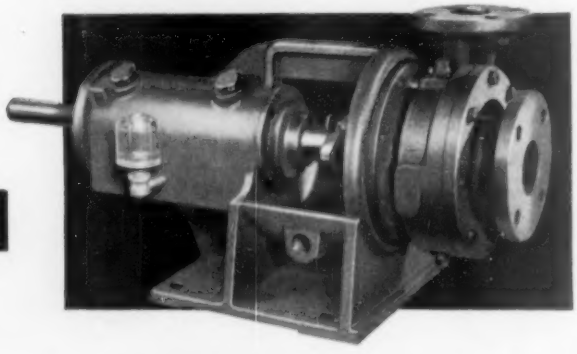


Salt water disposal is the job of this Allis-Chalmers pump in a southwestern oil field. It is driven by an Allis-Chalmers 10-hp motor.

You specify the materials in Allis-Chalmers

Frame-Mounted Pumps



Frame-mounted pumps, either grease or oil lubricated, are available with heads to 400 ft, capacities to 3500 gpm, temperatures to 550 F.

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Parts are available in almost every material used in pump construction — iron, bronze, stainless steel, high nickel alloys and others. In addition, you pick the sealing arrangement and specify direct coupling or V-belt drive.

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ALLIS-CHALMERS

a 7,100-ft. job for Sun Oil Co. at 1 Smith-Federal, in 4-5n-2e, 2½ miles north of Knoxville Tower field. The other also is for Sun. It is an 8,100-ft. Wilcox test at 1 Webb, in 5-2n-3w, about a mile north of Lessley.

Harry L. Edwards Drilling Co., Houston, has a new deep contract operation scheduled for the southeast-flank extension area of the old Anse La Butte dome, in St. Martin Parish, southern Louisiana. Contract is with Marine Gathering Co., a subsidiary of Commonwealth Oil Co. It will be a 12,000-ft. Nodosaria test, 1 Stokes.

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Longhorn Drilling Corp., Three Rivers, Tex., has a new 8,000-ft. operation in the East Alta Mesa area, Brooks County, South Texas. It is a contract job for Standard Oil Co. of Texas at 5 Braulia G. de Garcia, in Survey 3.

Sunnyland Contracting Co., Rayne, La., is drilling for Central Oil Co., of Laurel, Miss., at a wildcat location in southern Clarke County, southeastern Mississippi. Location, at 1 G. M. & O., in 12-10n-8w, is about 1¼ miles northwest of North Yellow Creek field, of northern Wayne County.

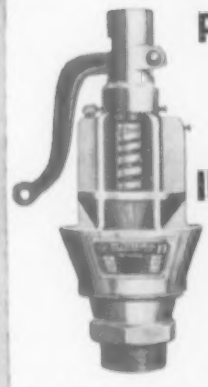
Circle Drilling Co., Lake Charles, is starting another deep well for Vincent & Welch, Inc., in the Grand Coulee area, of Acadia Parish, Louisiana Gulf Coast. Its location, 3 Reed, in 14-8s-1w, is off the northwest flank of present production. It is set up to go to 10,400 ft.

Field Drilling Co., San Antonio, is under contract for a 6,000-ft. test to be drilled for Forest Oil Corp. at a wildcat location 15 miles west of Rachal, in Brooks County, South Texas. It will be Forest's second test on its Mestena Oil & Gas Co. holdings. Location is in the Las Mestenas Ysidro Garcia Survey.

J. B. Fletcher Drilling Co., Shreveport, is putting down Michel T. Halbouty's Tuscaloosa test in the Lake Formosa area, western Tensas Parish, eastern Louisiana. It is an 8,400-ft. job. Location, at 1 Fisher, in 24-12n-10e, is southeast of Highland, and about 6 miles northeast of Holly Ridge field.

Vasser & Brown, Inc., Natchez, Miss., is on a new contract job in the Dismal Swamp area, southern Concordia Parish, in East Central Louisiana. It is a 6,800-ft. Wilcox test for Fred E. Simmons, Jr., of New Orleans, at his 1 Simmons-Metropolitan, in 18-3n-7e. Location is 7½ miles southwest of Slocum, and about 2 miles northwest of the discovery well of Chaney Lakes field.

H. J. Uhl Drilling Co. will drill a 3,100-ft. Skinner sand test for Elkhorn Oil Co., of Denver, at an extension location just south of Kaw City, in eastern Kay County, Oklahoma. Location is only a short distance north of Divanco Oil Co.'s new Skinner-sand development across the Arkansas River (county line) in western Osage County. The latter development is a northwest extension of the prolific Burbank area. The contractor will use a Wilson Giant rig which has been working for Divanco Oil Co.



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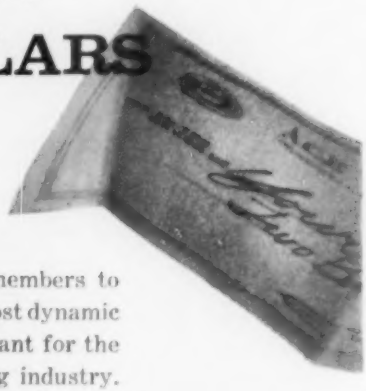

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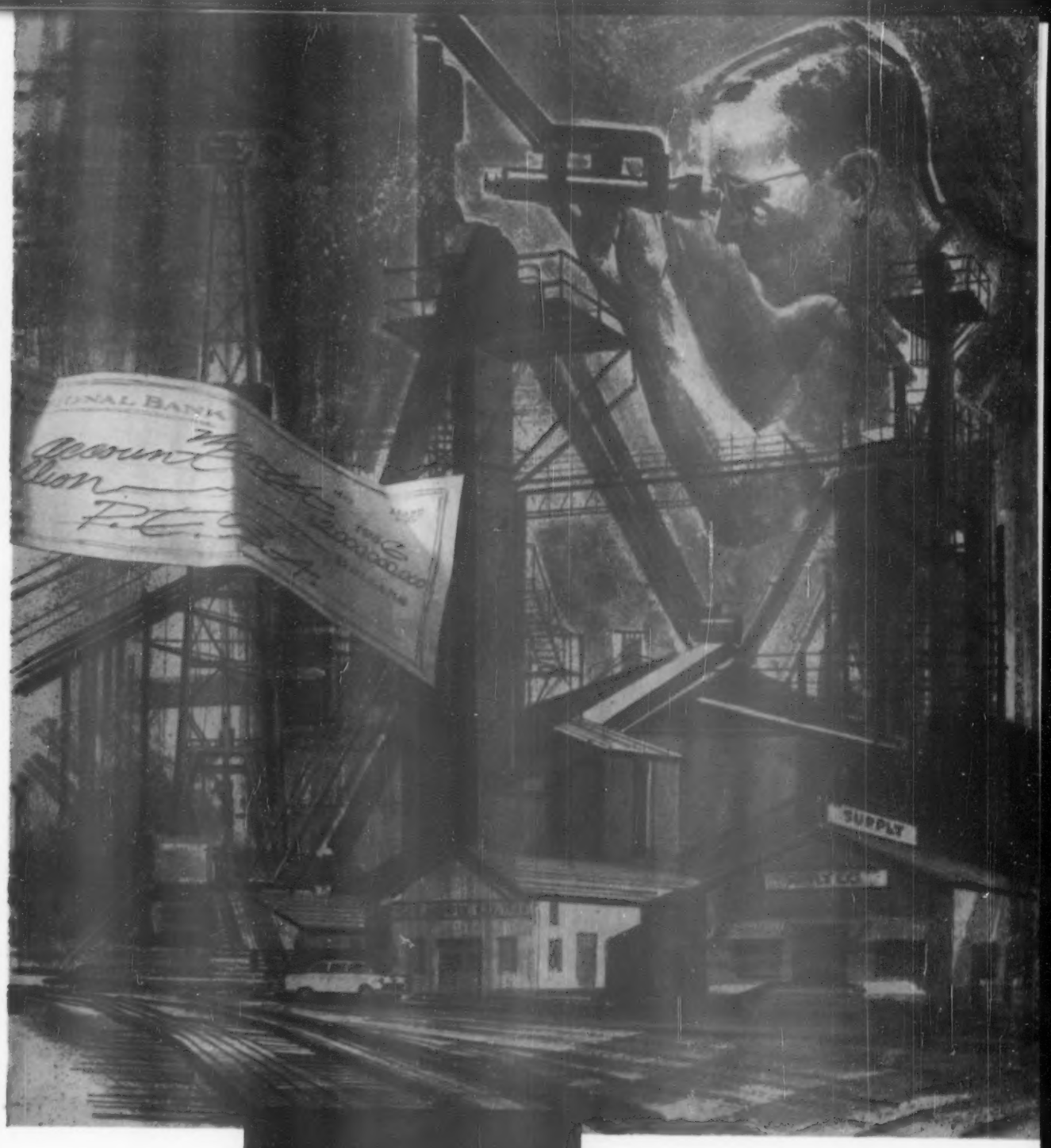

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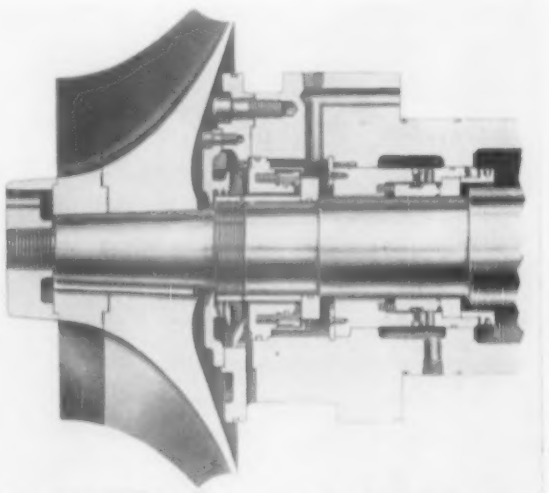
PART 2

Centrifugal compressors cut operating costs

Only five men are needed to operate a 15,000-hp. centrifugal-compressor station



BUSHING AND CONTACT SEAL combination has had a good record.

IN rare cases where oil, accumulated from leakage, is exposed to a stronger toxic or sulfur gas, it may be discarded or reclaimed by outside facilities. By proper selection of a seal on the gas side, oil consumption may be reduced to a very low level.

The illustrated system, using the bushing and contact seal combination, has had a good record. Wear of the bushing placed on the atmospheric side, when provided with ample rotating clearances is negligible.

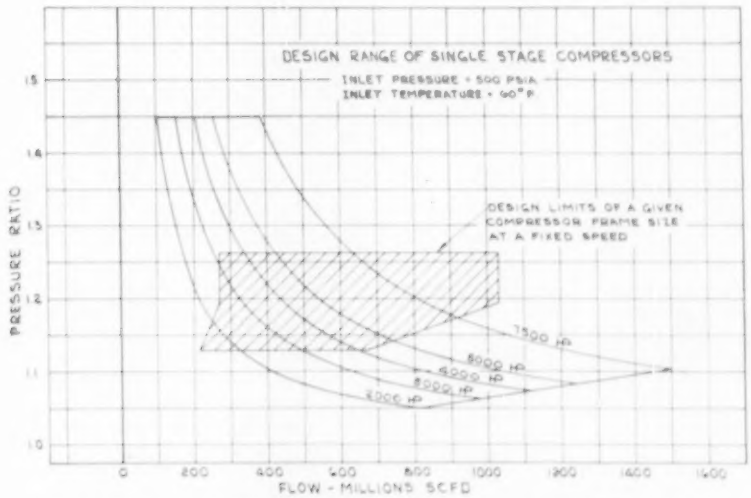
The contact seal also has shown high resistance to wear, indicating a normal life of 50,000 hours before replacement of the carbon ring is required. It is almost unaffected by shaft vibrations and momentary rough operation. In addition, it offers reliable service under abnormal operating conditions where pressure of the injected fluid is not maintained above the level of the gas pressure.

Material furnished by C. F. Koenig III, and L. J. Holveck, De Laval Steam Turbine Co., Trenton, N. J.

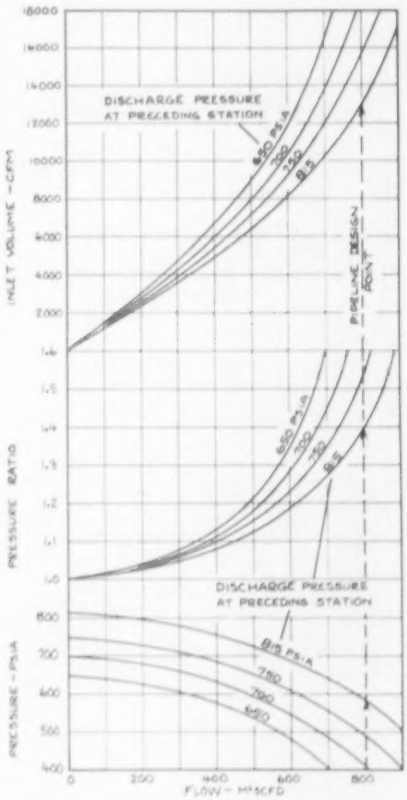
Cost factors . . . It is now appropriate to consider whether the use of the centrifugal compressor enables cost reductions, and if so, under what conditions and to what extent.

Here is the experience of one station (see Table 2 for partial summary). To operate a 15,000-hp. station using reciprocating compressors, the company required 27 men. The same power developed by a centrifugal-compressor station required five men. Fuel consumption of the reciprocating-compressor station was 10.83 cu. ft. of gas per brake horsepower-hour. The turbine-compressor station used 10.5 cu. ft. of gas.

Oil consumption of the reciprocating unit was 1 gal. per 2,700 b.hp.-hr. The turbine unit produced 30,000 b.hp. for the same oil consumption. Water requirement of the reciprocating-com-


DESIGN RANGE OF SINGLE STAGE COMPRESSORS
INLET PRESSURE = 500 PSIA
INLET TEMPERATURE = 60°F
DESIGN LIMITS OF A GIVEN COMPRESSOR FRAME SIZE AT A FIXED SPEED
7500 HP
6000 HP
5000 HP
4000 HP
PRESSURE RATIO
FLOW - MILLIONS SCFD

SINGLE-STAGE COMPRESSOR DESIGN shown here with pressure ratio. Fig. 4.



PIPELINE-FLOW characteristics with 32½-mile station spacing. Fig. 5.

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PIPELINE PATROL

RADIAL IMPELLER is specified for moderate flow and high pressure boost. Fig. 6.

OPEN-FACED mixed-flow impeller. Fig. 7.

pressor station was 135 g.p.m.—of the turbine compressor, 30 g.p.m.

Auxiliary power for the reciprocating station was 520 kw. A 400-amp.-hr. battery served the turbine-compressor station. A total survey of operating costs showed a reduction of 33⅓ per cent over a 1-year period. Dollarwise, the study showed that operating cost of the turbine-compressor station was about $50 less per horsepower than for the reciprocating station.

Cost of construction was lower also—$235 per brake horsepower for the reciprocating station and $198 per brake horsepower for the turbine-compressor station.

TABLE 2—COMPARISON SUMMARY

	Compressor station (15,000 hp.)	
	Reciprocating	Centrifugal
Manpower, men	27	5
Fuel per b.hp.-hr., cu. ft.	10.83	10.5
Oil per 30,000 b.hp.-hr., gal.	11	1
Water, g.p.m.	135	30
Construction cost per b.hp.	$235	$198

Operational . . . In the field of costs, perhaps the most important advantage of the centrifugal compressor is that a total of only five men may operate one, two, or three-unit stations and in the winter these stations develop 25 per cent additional horsepower at no extra cost.

Little or no water is required and the machine will operate without an air washer. It is thus adapted for intermittent use in cold climates or for use in locations where water is scarce.

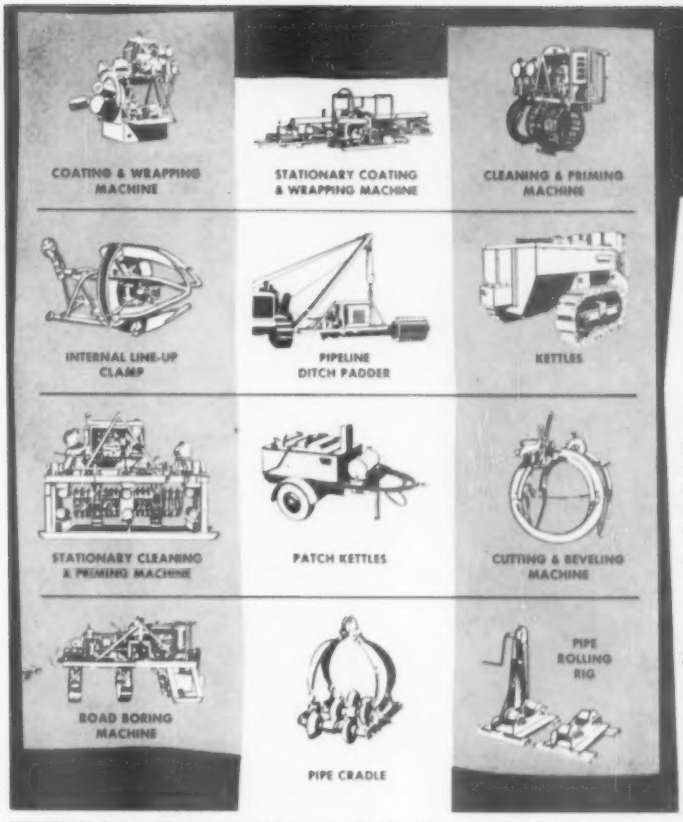
As pointed out before, oil consumption is very low and there is no danger that oil will enter the pipeline and promote clogging. Turbine-compressor units are self-sustaining and require no outside power. No pulsations are transmitted to the pipe.

Since each unit occupies a relatively small physical area, the cost of the building is reduced and comparatively little concrete is required in the foundation because the vibration of the turbine compressor is extremely low compared to the reciprocating compressor.[1]

These accumulated advantages permit closer station spacing and higher capacity at a much lower cost than would be the case with reciprocating stations (see Table 2).

Closer station spacing, in turn, allows the line to operate with higher flexibility and it is now appropriate to treat this subject in more detail, particularly as it affects the growth of the pipeline.

Flow pattern . . . A typical pipeline will have pressure-flow characteristics as shown in Fig. 2 *(The Oil and Gas Journal, October 22, page 139)*. Such characteristics are determined by the familiar equations for pipeline flow or, more readily, by the slide rule designed by T. R. Rhea. The pressure ratio and horsepower required by centrifugal compressors to raise the pressure to the starting pressure at any point along the line are shown in Fig. 3 *(The Oil and Gas Journal, October 22, page 140)*. The actual volume of gas in cubic feet per minute is shown also.



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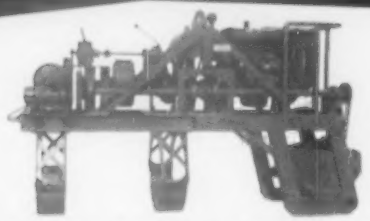

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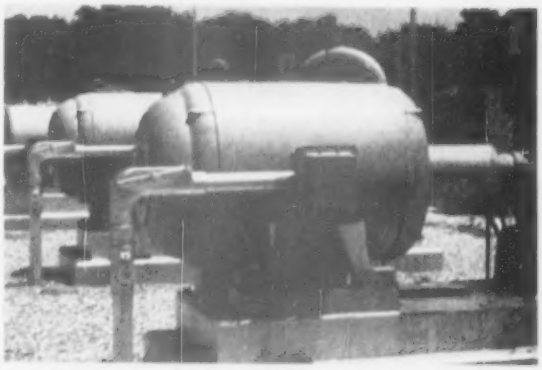

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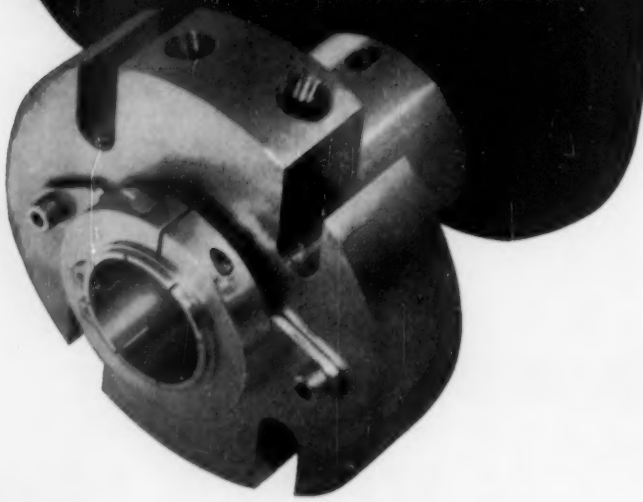

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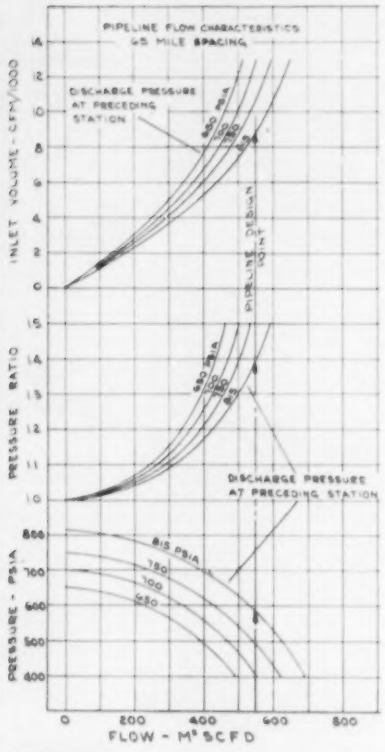
PIPELINE PATROL



PIPELINE-FLOW characteristics with 65-mile spacing. Fig. 8.

Finally, assuming a unit-driver horsepower of 5,000, single-unit stations have been spotted at 130-mile spacing for the initial condition of 350 M.M.s.c.f.d., two-unit stations at 65-mile spacing for the intermediate condition of 550 M.M.s.c.f.d., and three-unit stations at 32.5-mile spacing for the ultimate condition of 800 M.M.s.c.f.d.

Figs. 4 and 5 show the pressures, horsepowers and station spacings which will be involved for each growth step of the pipeline. As in the case of the pipeline itself, the compressors should be designed for the ultimate requirements, but smaller capacity elements, usually impellers, diffusers, and adjacent minor parts, may be necessary for the early, low-capacity operation of the line.

When the flow is increased to design value these small-capacity impellers and diffusers will be replaced by those for the ultimate design (see Figs. 5 and 6).

References

1. Cooper, G. C., Jr., "Operating Experience with First Pipeline Centrifugal Compressor," The Oil and Gas Journal, July 13, 1953.

The OIL AND GAS JOURNAL

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by Dan B. Miller

New Mud Permits Better Shale-Formation Drilling

A new mud improves drilling-fluid performance in troublesome shale formations. In addition to hole stabilization and inhibited shale hydration the new mud can be used wherever lime mud can be employed. Besides being more efficient than lime, T-8 mud also is effective for penetration of the troublesome shale zones. T-8 is easy to control and is safe to use. It offers good hole stability. Use of the mud improves electric logs and results in better production.

The mud is prepared using T-8 compound as the conversion and primary maintenance chemical. It creates a mud system that is in a state of controlled dispersion when operated within the proper chemical limits. T-8 compound is a complete mud-chemical treatment, and under most conditions it is all that is needed to properly maintain the chemistry of a T-8 mud. The mud has been used in deep wells with very good results and it has been successful in drilling in gouge zones around salt domes. **For more information write or call: Magnet Cove Barium Corp., P. O. Box 6504, Houston, Tex.**

●

New Perforator Permits Assembly to Order at Well

A new oil-well perforator permits assembly to order at the well. Called the Kwik-Kone gun, it is made of flat steel sections which bolt together to form shaped-charge carriers of practically any length required for the job.

This sectional assembly increases speed on the rig. It allows easy setup for varying shot densities as required, since the carrier can be assembled and loaded on the job. With a 50-ft. gun, as many as 200 shots are possible on one run, to handle long zones quickly. **For more information write or call: Lane-Wells Co., P. O. Box 2194, Terminal Annex, Los Angeles 54, Calif.**

Direction Reverser Saves Tractor Time

A direction reverser on crawler or utility tractors permit forward or backward travel at the same speed without shifting gears. Available on the 420 tractors, this is a real time-saving feature when dozing, digging, and handling loading operations, especially in tight quarters.

An easy-to-attach foot throttle increases engine and ground-travel speeds up to 25 per cent, making possible travel speeds (with wheel-type tractors) up to 17 m.p.h. on the highway.

For increased versatility in many operations, a five-speed transmission is offered for all models of this company's industrial tractors. The extra speed forward on 420 utility tractors is 6¼ m.p.h. and on the crawler 3⅞ m.p.h.

A heavy-duty three-point hitch is now available for 420 crawler tractors

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OIL AND GAS JOURNAL Showcase ..... OF NEW EQUIPMENT

to combine the advantages of pick-up-and-go operation with the all-weather operational features of crawler-type tractors. **For more information write or call: John Deere Industrial Division, Moline, Ill.**

●

Pumping Unit Designed For Low-Volume Wells

The 4-ft. Junior Hydrax pumping unit, with an 8,000-lb. polished rod capacity, meets the increasing demand for economical production of low-volume stripper-type wells of 50 bbl. per day or less.

Simple to operate, an adjustment of a reverse valve located on the reservoir tank at ground level will provide a downstroke time ranging from 2 seconds. Upstroke time is determined by pump speed. Other features are wide range of application, simplicity of design, and ease of installation. Foundations or special footings are not required for normal operations. The unit

is a pedestal type and mounted on the production tee. **For more information write or call: Axelson Manufacturing Co., Division of U. S. Industries, Inc., 6160 South Boyle Avenue, Los Angeles 58, Calif.**

Bottom-Hole Sampler Gives Positive Depth Indication

A bottom-hole sampler obtains true samples of fluids in well bores. It operates from the surface and gives positive indication of depth at which the sample is taken. The sampler contains a minimum number of parts and no complicated mechanism to fail. It allows no carry-down of fluid in high-viscosity wells.

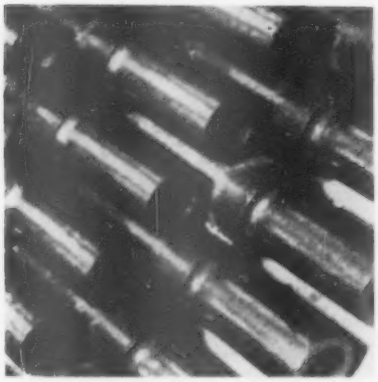
Constructed throughout of stainless steel, it is 1½ in. in diameter and 67 in. long, with a capacity of 1 l. Transfer procedure is simple and does not require the use of mercury. Sample pressure can be determined at the wellhead without opening the sampler. **For more information write or call: Coleman Instrument Co., Box 5127, Tulsa 20, Okla.**

●

Forgings Save Time in Hollow-Cylinder Machining

Of seamless steel tubing, these high-grade forgings offer savings in material and labor when used to make hollow-cylinder machine parts. Tolerances in diameter and wall thickness are small

Otis...
"First in Pressure Control"



Only a minimum of machining is required. Hollow shapes with inside or outside collars, shoulders, reducing flanges, and tapering connections are made from these forgings.

During manufacture, a continuous, fully automatic process, the material receives a thorough forging. Raw forgings already possess a homogeneous texture and high strength before they are machined. The maximum inside diameter of the forgings fall between 140 and 145 mm. The maximum length is about 1,000 mm. **For more information write or call: Mannesmann Aktiengesellschaft, Postfach 6037, Duesseldorf, Germany.**

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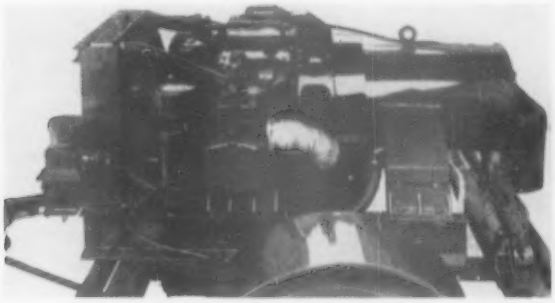

Engine-Generator Powers Microwave

The new Model 100RDA engine-generator unit powers microwave installations. The unit produces 12,000 watts continuously, 24 hours a day. A heavy-duty, industrial-type generator is direct-connected to an 18-hp., water-cooled diesel engine. The horizontal, balanced design makes possible a strong unit with a low profile (approximately 30 in. high), so that it is suitable where space must be conserved. The engine-generator set operates without being secured.

Approximate over-all dimensions are: length 65 in.; height 30 in.; and width 39 in. Weight is 1,700 lb. The engine, with 100.5-cu.-in. displacement, drives the generator at 1,800 r.p.m. An inherently regulated, three-phase, 60-cycle generator is normally furnished. **For more information write or call: Witte Engine Works, Oil Well Supply Divi-**

OTIS PERMANENT COMPLETIONS

It was reported in the trade press recently that an operator in South Louisiana saved an average of 34 hours' rig time alone for each permanently-completed well. The tubing and wellhead are installed only once in a permanent completion — then the rig can be moved off. Perforating, testing, and placing the well on production are performed with wire line equipment at considerable savings over conventional methods. Heavy pipe-handling equipment normally used for workover operations is eliminated. And most significant about permanent completions is the number of *different* operations which can be performed *without a rig or workover unit.*

Squeeze-cementing and acidizing • Perforating casing below tubing • Plugback jobs
Sand bailing • Bottom-hole pressure tests and formation fluids sampling
Running sub-surface flow meters • Choice of fluid in the well bore when perforating
Testing stringer sands • Dry-testing cement jobs with tubing and packer in place
Radioactivity logging through tubing • And many others — all of which reduce workover time and costs, provide safer operations, and make a better producer.

Otis is the industry's recognized authority on wire line services and equipment for permanent completions. If you would like to have more information on the flexibility and operating advantages of permanently-completed wells, call your nearest Otis office. You will find them anxious to help you, and you will be impressed with the complete and competent information they will give you.

OTIS

OTIS PRESSURE CONTROL, INC.
Branches Throughout the Oil Country

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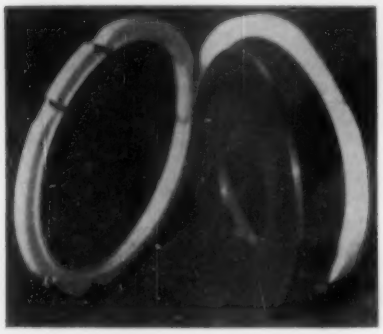
sion, United States Steel Corp., 1614 Oakland Avenue, Kansas City, Mo.

●



New Orifice-Plate Sealing Unit Is Made of Teflon

Made of Teflon, a new orifice-plate sealing unit fits in Daniel senior and junior fittings and Simplex plate holders. This unit gives an effective seal on both orifice plate and fitting seat. Annular grooves allow contraction and expansion, maintaining continuous seal. Soft texture eliminates scratches caused by metal-to-metal contact. The new TS seal is a simple, two-piece unit that locks securely around the orifice plate with ring clips and is recessed to receive the No. 500 orifice plate. The plate can be removed by hand pressure alone.

Field tests show that TS seals operate effectively in a temperature range of —65° to +500° F. They work in wet, corrosive, dry, or high-pressure service. Their self-lubricating feature makes it particularly good in dry service. **For more information write or call: Daniel Orifice Fitting Co., P. O. Box 19097, Houston, Tex.**

●

Refractometer Monitors Liquid Process Streams

A new process refractometer monitors continuously the refractive index of liquid process streams in refineries and chemical plants. Known as Type 38-202 process refractometer, it is an improved version of an earlier type which has seen successful use in the automatic control of liquid stream blending and fractionator-tower operation.

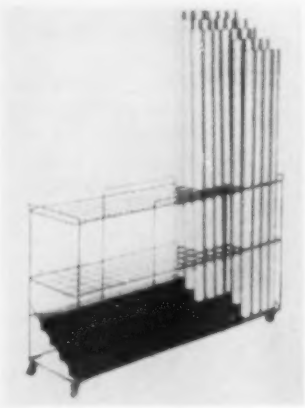
The instrument is designed for around-the-clock operation under adverse environmental conditions. The entire electronic and optical system is housed in a pressed-steel bell to provide explosionproofing for Class I, Group C hazardous locations. The Type 38-202 is simple, compact, and requires only a 2 by 4-ft. floor area.

Maximum full-scale sensitivity is 0.001 refractive index units, while minimum full-scale sensitivity is 0.20 refractive index units. Reproducibility of

sample reading is ±½ per cent of full-scale plan. The indicator knob on the front panel is calibrated in arbitrary units of 0 to 300. For most applications the midpoint of the indicator scale is set to correspond to the refractive index of the locked-in sample to permit observing both plus and minus deviations of the flowing sample. **For more information write or call: Consolidated Electrodynamics Corp., 300 North Sierra Madre Villa, Pasadena, Calif.**

●

Map Rack Has Graduated Steps for Visibility



This map rack, lightweight and easy to wheel around on ball-bearing casters, is a complete self-contained department. To make map identification easy, graduated steps put the maps on different levels.

Kraft-wrapped tubes, with metal ends, protect the maps. A 6-in. telescope cap, topping each tube, can be labeled and indexed. Made in 43 and

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WHEN PERFORMANCE - QUALITY - TIME *really* COUNT

Modern methods, the finest up-to-date equipment, and well-trained experienced, year 'round crews take over every job with these three things in mind — performance, quality, and time — fulfilling our contractual obligations to your complete satisfaction. All your pipeline operations begin well ahead of schedule when you contract with H. B. Zachry Company.

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GENERAL CONTRACTORS

PIPE LINE DEPT.
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55-in. lengths, all tubes are treated inside for better map preservation.

The four models are sized according to openings. Three have 30, 60, or 100 openings, with 2½-in. capacity. The professional, for larger maps, has 36 openings, each 3½ in. in diameter. **For more information write or call: Frontier Manufacturing Co., 11200 Harry Hines Boulevard, Dallas, Tex.**

●

Breather Springs Prevent Damage to Tank Insulation

Breather springs solve the problem of damaged insulation that occurs when

hot tanks, towers, pipes, and vessels expand and contract. In the original recommended length breather springs are 4 in. long. At fully expanded length they measure 16 in. This 12-in. spread for expansion eliminates insulation damage during expansion or contraction.

Made from Techalloy 0.105-in. diameter stainless steel, this product has a tensile strength of 275,000 psi., high resistance to chemicals and acids, and excellent spring advantages up to 600° F. It is only ⅜ in. thick. This thin-line construction stops protrusion through covering materials.

Breather springs can be used with any type bands in widths of ⅜, ½, or ¾ in. in thicknesses of 0.015 or 0.20 in. **For more information write or call: Techalloy Co., Inc., Rahns, Pa.**

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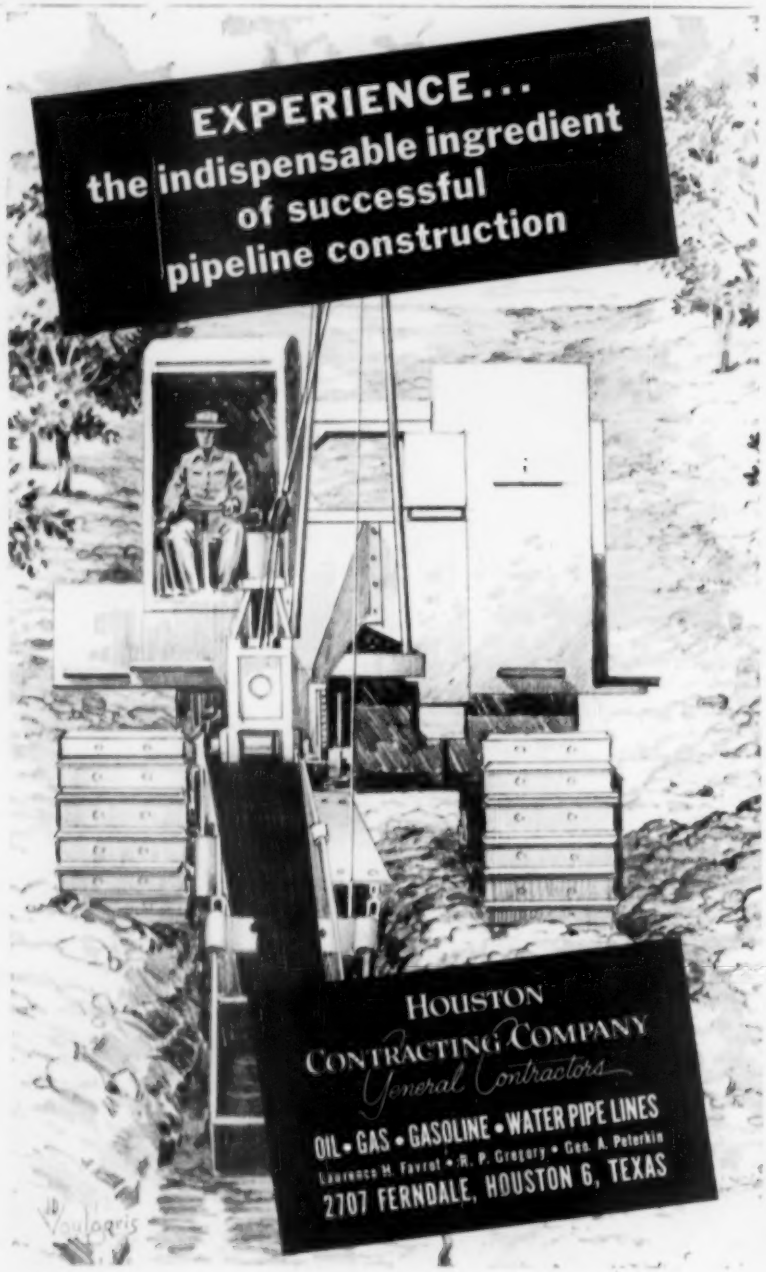
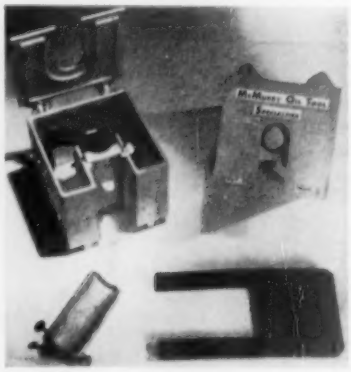




Polish-Rod Lubricator Saves on Oil, Won't Flood

A new slide-gate, polish-rod lubricator furnishes ample lubrication to the rod without flooding. The oil reservoir requires filling approximately once a week. Sliding the gate section out of the main body allows the lubricator to slip on or off the rod easily. The hard felt wick has a prolonged life. The lubricator sets on top of the stuffing box, is not attached to it. **For more information write or call: McMurry Oil Tool Specialties, 1020 Houston Avenue, Houston, Tex.**

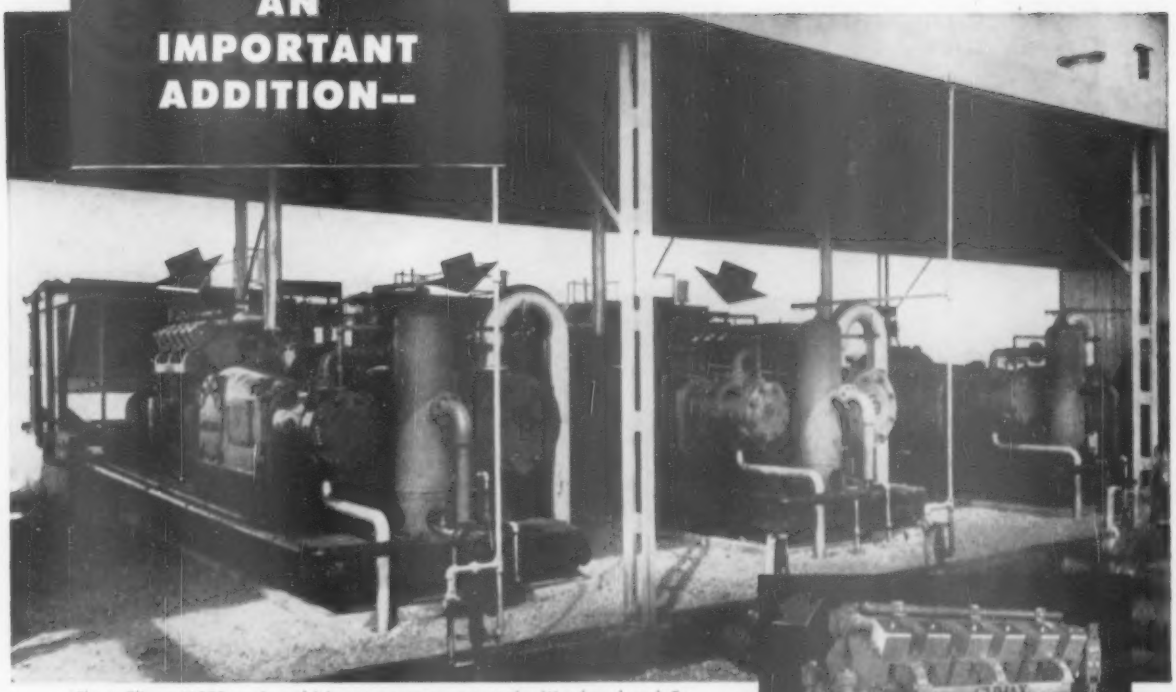
●

Gasoline Copper Deactivator Remains Liquid at 0° F.

A new nonfreezing copper deactivator remains liquid at temperatures of 0° F. and above. Traces (usually less than 1 p.p.m.) of copper are often found in gasolines. These copper impurities exert a strong catalytic effect on the oxidation, gum formation, and tetraethyl lead decomposition in commercial gasolines. Copper deactivators react with these traces of copper and destroy their catalytic activity.

Called copper deactivator AW (50), the new formulation contains regular active ingredient in 50 per cent concentration in solution. It eliminates the problems of freezing and low temperature pumping which are characteristic of regular-grade deactivators. **For more information write or call: Universal Oil Products Co., 30 Algonquin Road, Des Plaines, Ill.**

AN IMPORTANT ADDITION--



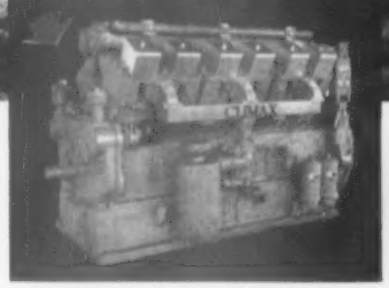
Three Climax V-122 engines driving gas compressors at the Woodward and Co. Gasoline Plant near East Washington, Okla.

TO A *GROWING LIST* OF CLIMAX ENGINE INSTALLATIONS

Climax heavy duty gas engines were selected to drive the compressors in Woodward and Company's new gasoline plant near East Washington, Oklahoma. This plant, having a design capacity of 3.5 million cubic feet per day, was engineered and constructed by Tinkham Engineering & Construction Company of Dallas, Texas, and includes three Model V-122 Climax engines driving Oil Well Supply DGE-250 gas compressors.

Rugged construction, modern design and a reputation for long service with maximum economy and minimum down time are features which make Climax engines outstanding wherever dependable power is required.

Climax engines are specially designed for compressor drive and are available in sizes from 100 to 350 H.P. for 24-hour round-the-clock service.



A Climax V-122, 12 cylinder, 7 x 7 engine with a 3232 cubic inch displacement.

OUTSTANDING FEATURES OF CLIMAX V & K SERIES ENGINES

- All models have renewable cylinder sleeves.
- All intake and exhaust valves are free-to-rotate type.
- All crankshafts are supported by bearings on each side of each crankthrow.
- All connecting rods are rifle drilled for pressure lubrication of piston pins.
- All cylinder heads have Climax high-turbulence type combustion chambers which produce maximum fuel economy.
- All models have the Climax consistent design that makes possible maximum interchangeability of wearing parts.

Write today for your copy of bulletin SA-611, "Special Power Units for Gas Compressors."

WHERE POWER IS YOUR PROBLEM — CLIMAX IS YOUR ANSWER

climax BLUE STREAK ENGINES

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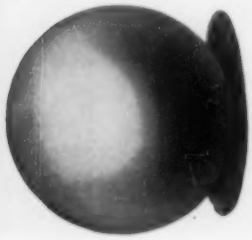
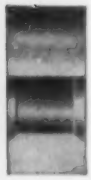
For best service use the right Baird ball with the right Baird seat.

"Sheralloy" Ball
Excellent to combat corrosion and hard enough for deep pumping. Non-magnetic.

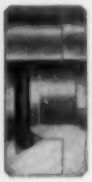
"Ceramic" Ball
Nearly as hard as a diamond. Non-corrosive and non-magnetic.

"Stainless Steel" Ball
For ordinary pumping where little trouble is encountered.

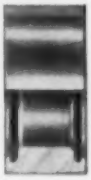




"Single Seal" Seat
A competitively priced stainless steel seat for routine pumping.



"Double Seal" Seat
For harder than usual pumping — double contact with the ball.



"O-Ring Seal"
A 2-piece stainless steel seat specially recommended where ordinary or fracturing sand is causing seat failures.

"Sheralloy" Seat
A cast alloy definitely proved resistant to corrosion. Also good for hard pumping.

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Superpressure Tubing, designed for safe service at pressures up to 100,000 psi., is described in Data Memorandum 22. The tubing is supplied either as heavy single or as double (composite) wall tubing. The composite wall tubing is made by drawing a larger tube over a small one, establishing a mechanical bond between the two. Different alloys may be combined for extra strength and corrosion resistance if the annealing characteristics of the materials are compatible. Tubing is furnished in 10 standard sizes from ⅛ to ¾-in. o.d. in increments of ⅛ in. A table lists the maximum wall thickness for each size and gives the minimum bursting pressure for single wall tubing in each size and wall thickness. Minimum bursting pressures for composite tubing are slightly higher. Data Memorandum 22 includes seven formulas most generally used or cited for determining the stresses set up in the walls of a tube by the pressure of fluids within the tube. **For more information write or call: Superior Tube Co., 1764 Germantown Avenue, Norristown, Pa.**

•

Parkersburg DAU Units for Wellhead Dehydration and for Hydrocarbon Recovery is the title of a 24-page technical paper. It covers the use of wellhead dehydrator for producing gas wells to combat corrosion and hydrate formation in high-pressure pipelines. A new dry desiccant adsorption unit for wellhead applications is automatic, self-contained, skid-mounted, and does not require an external source of energy. It also recovers up to 50 per cent of the pentanes in a gas stream. The technical paper presents photographs, schematic flow diagrams, and graphs. **For more information write or call: Parkersburg Rig & Reel Co., P. O. Box 12007, Fort Worth 16, Tex.**

•

How to Avoid Crooked Holes and Control Deviation is the subject of a new, handy pocket-size booklet. Using easy-to-follow illustrations it deals with such problems as: how much more weight can be carried by using a sta-

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ANY VARIABLE
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POWER
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Telemeter transmitter converts DC mv from thermal converters, etc. to 10-30 cps which frequency modulates an audio tone channel. Receiver detects and demodulates transmitted signal, generating a DC mv for operation of recorders or indicating instruments. Up to 45 telemeters can be multiplexed. Any communication link, including power line carrier, may be used. Overall accuracy is 1% with a response speed of 1 sec.

Other terminals for teletype, voice-plus-control & data transmission are available.

Write for Technical and Application Data.

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LABORATORIES, INC.
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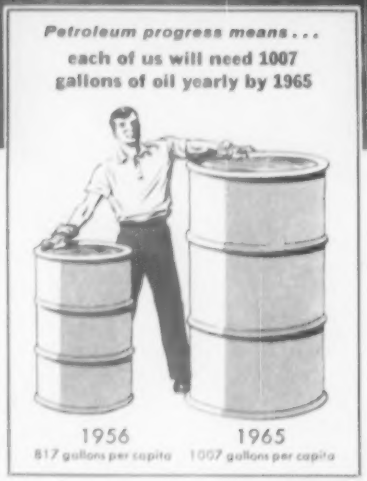
25 cents of every dollar Standard takes in goes to meet your future oil needs

Our search for oil has carried us to the sea, even though drilling offshore wells like this one (in the Gulf of Mexico) costs nearly 6 times more than land wells.

BUILDING "ISLANDS" IN THE SEA from which to probe the ocean floor is one good example of how we must search farther afield to find the oil America uses in such quantity. And as new sources of oil become harder to find, locating it and bringing petroleum products to you grows more costly.

Last year, a quarter of every dollar Standard took in was plowed back into oil exploration, development of producing fields, research and construction of facilities. All told, during 1955 we invested $347 million to help meet your growing oil needs.


Petroleum progress means . . .
each of us will need 1007 gallons of oil yearly by 1965
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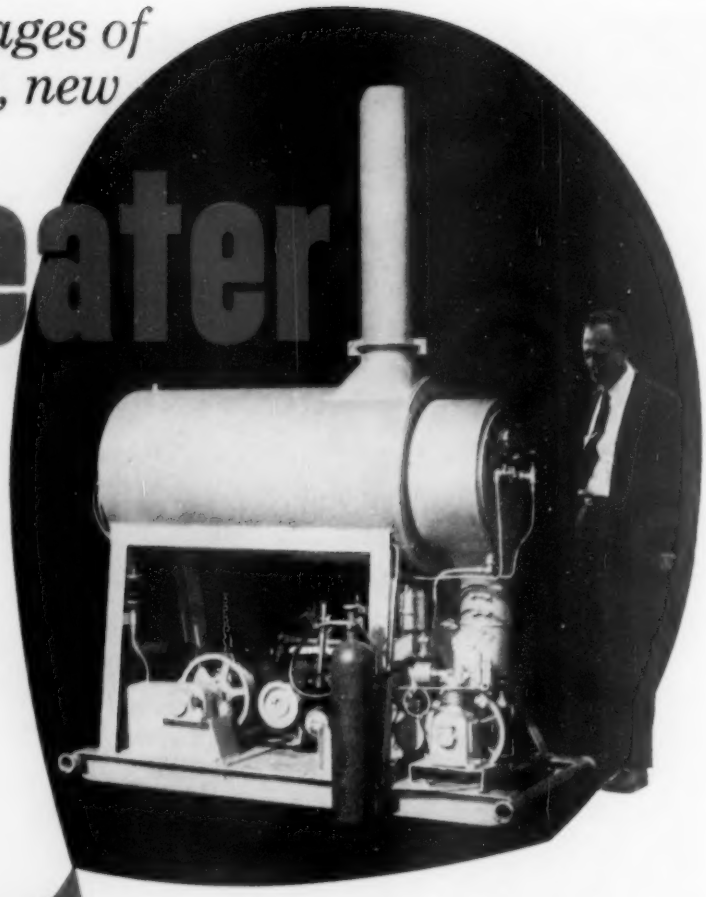
817 gallons per capita
1965
1007 gallons per capita

STANDARD OIL COMPANY OF CALIFORNIA

puts petroleum progress to work for you

Check these advantages of Texsteam's portable, new

25M Texheater



This multi-purpose, portable hot-oil heater is a complete packaged unit. It generates 2.5 million B.T.U. per hour, heating 70 bbls. of production crude per hour to a controlled outlet temperature. Weight, only 2,680 lbs.; height 65″; Length 83″; width 36″.

Field-proven for use in:

- Treating of oil in stock tanks
- Removal of paraffin from flow lines
- Removal of paraffin from tubing strings
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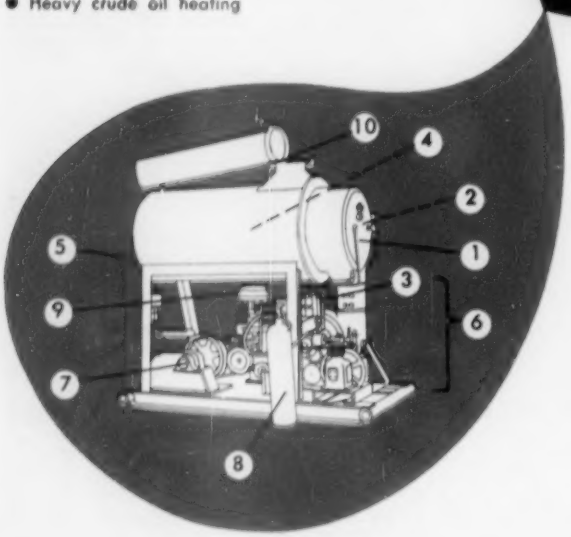
- Heater-treater installations
- Pipe line heating
- Hot water heating
- Heavy crude oil heating



Ten features for safe, trouble-free operation:

1. **CRUDE OIL BURNER** — Most production oil may be used as fuel. Also natural gas and domestic fuels may be used. Automatic damper control.

2. **CO_2 QUENCHING RING** offers built-in fire protection by extinguishing burner in a split-second.

3. **AUTOMATIC MOTOR SHUT-DOWN**, operated by CO_2.

4. **HIGHLY EFFICIENT, COMPACT HEAT EXCHANGE UNIT.**

5. **AUTOMATIC ADJUSTABLE TEMPERATURE CONTROL.**

6. **EASE OF MAINTENANCE.** All components easily accessible.

7. **HEAVY-DUTY CIRCULATING PUMP.**

8. **CO_2 BOTTLE** can be mounted for remote shutdown.

9. **PRIME MOVER** per customer's specifications.

10. **HINGED STACK** for easy portability.

Write for Bulletin No. 25M for complete details on the 25M Texheater.

TXT INJECTORS
TEX-STEAMERS
TXT VALVES
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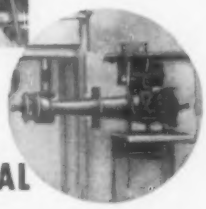
TEXSTEAM CORPORATION

DIVISION OF VAPOR HEATING CORPORATION

320 Hughes St., Houston 11, Texas

VERTICAL



OR

HORIZONTAL

many more hours on stream without forced shutdown with NATIONAL AIROIL

OIL-GAS TANDEM COMBUSTION UNITS

Exclusively for vertical firing, the new National Airoil VERTICAL Tandem Block Units retain all the features of our regular horizontal Tandem Units . . . **plus:** special, precast refractory shapes for easier, cost-saving vertical installation and maintenance; secondary air inlet louvres for positive control of vertical flame pattern; and, all steel duplex detaching gear which enables swift, simple vertical burner changeover.

VERTICAL and HORIZONTAL Tandem Units hold air in the combustion zone until fuel and heated air are thoroughly mixed. This means that ignition takes place in a hot zone; the result: high fuel economy with a minimum of excess air. NATIONAL AIROIL's patented Tandem Combustion Units allow secondary air to be easily and accurately controlled. By adjusting air control louvres, flame can be shaped to radiate heat uniformly without tube impingement.

The VERTICAL or HORIZONTAL Tandem Unit is always fired with NATIONAL AIROIL combination Oil and Gas Burners . . . has a high turndown ratio with a steady flame temperature using either fuel oil or gas. With the TANDEM UNIT's clean flame, a cold furnace can be brought to full capacity in a short time.

"Many, many more hours on stream, without shutdown" . . . yes, YOU will realize higher profits from YOUR heaters when NATIONAL AIROIL VERTICAL or HORIZONTAL Tandem Units are specified. Our new Bulletin 498 is yours for the asking.

CHEMICAL-PETROLEUM DIVISION

NATIONAL AIROIL BURNER CO., INC.

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Southwestern Division
2512 South Boulevard, Houston 6, Texas
INDUSTRIAL OIL BURNERS, GAS BURNERS, AND FURNACE EQUIPMENT

bilizer without increasing deviation; what combination of stabilizer and drill collars should be used to change the hole angle or drill a new hole with a reduced angle in the same formation; and what combination of drill collars and stabilizer must be used when reducing hole in order not to exceed the deviation of the larger hole in the reduced hole. **For more information write or call: Grant Oil Tool Co., 2042 East Vernon Avenue, Los Angeles 58, Calif.**

•

National Well-Head Equipment is cataloged in Bulletin 444. The 20-page booklet gives specifications and design features of equipment for the whole range of well depths and pressures: Illustrated instructions for triple sealing a wellhead are included. **For more information write or call: The National Supply Co., Gateway Center, Pittsburgh 22, Pa.**

•

Wire-Line Services are covered in this company's 16-page color brochure. Including a brief history of the company, the brochure illustrates the ⅞-in. line-perforating truck, the ⅝-in. line through-tubing perforating truck and accessory equipment, gamma ray-neutron logging instrumentation, gun perforators, and jet perforators. **For more information write or call: Great Lakes Petroleum Services, Inc., P. O. Box 2050, Houston, Tex.**

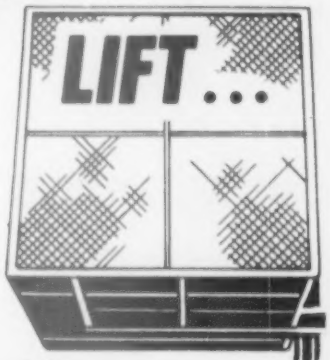
•

Sentry Full-Flow Valves are illustrated and described in Bulletin 500. It is a two-color, four-page bulletin that utilizes engineering drawings to point out the details of the six valves offered. It includes excess-flow shut-off valves, high and low-pressure shut-off valves, and solenoid valves. Also detailed are overpressure and overtemperature shut-off valves and piston-operated quick-opening valves. The bulletin lists standard materials and specification for them. **For more information write or call: Coppus Engineering Corp., Worcester 2, Mass.**

•

Cobalt Molybdenum Catalysts, a new technical bulletin, describes in detail G-35 cobalt molybdenum catalysts for upgrading a wide molecular weight range of petroleum stocks by hydrogen treating. The bulletin points out that naphthas, middle distillates, heavy-gas oils, and heavy oils can be upgraded with good results. General reactions are listed and described. Typical flow diagrams and reactions in hydrogen treating petroleum feed stocks over G-35 cobalt molybdeum catalysts are in-

give your plant a



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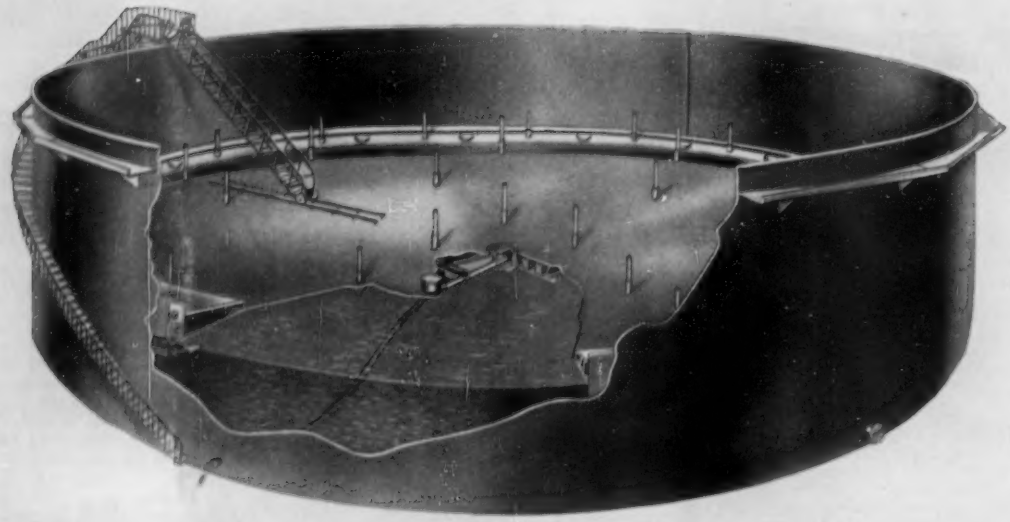
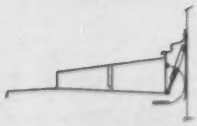


STABLE . . . because, ship-like, the center of buoyancy is below the center of gravity.

CORROSION-RESISTANT . . . because the liquid in storage is in full contact with the deck.

SELF-DRAINING . . . rainfall flows to the Graver sump at the center low point of the roof.



VAPOR-STOP SEAL . . . Graver's patented single seal . . . proved effective against vapor loss.

. . . FOR A NEW, LOW-COST FLOATING ROOF TANK WITH UNDER-DECK CENTER WEIGHT

Here is another outstanding Graver first in single-deck floating roof tanks. We've cleared the deck for easy snow removal and positive drainage by putting the center weight *below* the deck. This effects additional economies in construction without sacrificing the long-established advantages of Graver's patented single-deck floating roof principle and characteristic Graver quality. This new Graver floating roof tank (both pontoon and pan type) has been thoroughly proved by installations across the nation. May we give you complete details?

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EAST CHICAGO, INDIANA • NEW YORK • PHILADELPHIA • EDGE MOOR, DELAWARE
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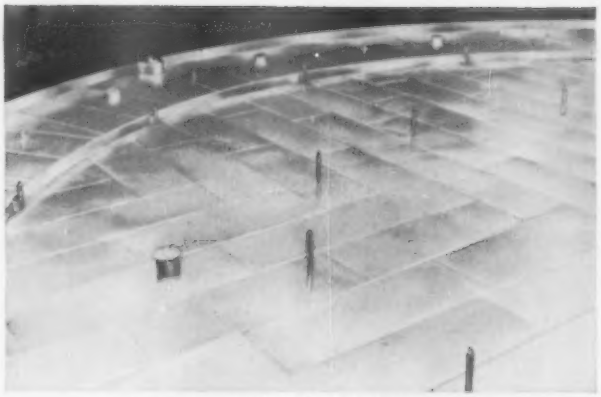


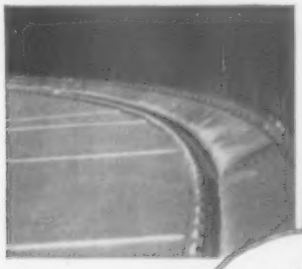
New Jersey—140′ x 40′—110,000 bbl. capacity

California—160′ x 40′—140,000 bbl. capacity

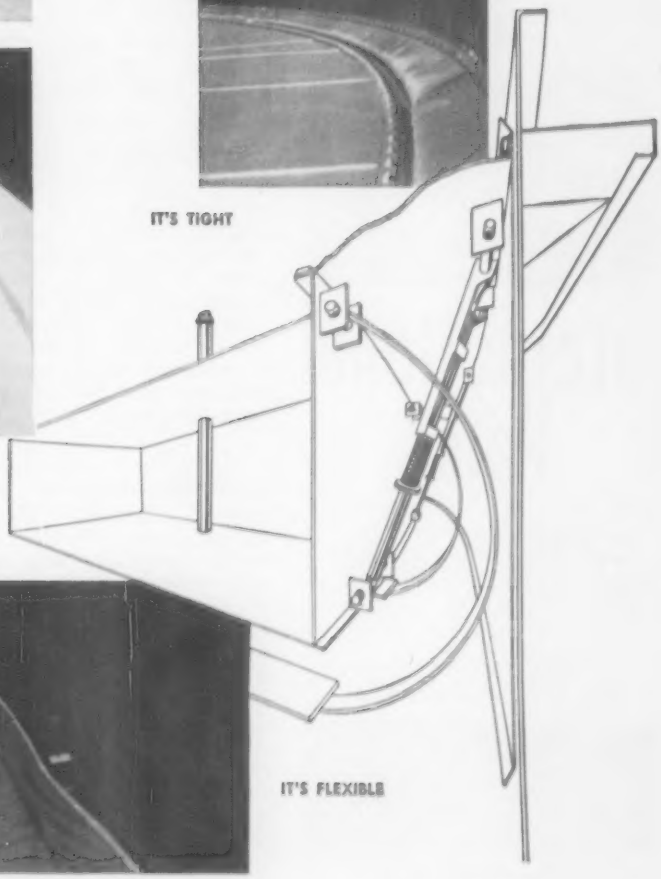
Texas—90′ x 48′—55,000 bbl. capacity

PROVED WHERE ECONOMY COUNTS...

The demands for more production and greater storage capacity with the least investment has attracted a number of well-known companies to the new low-cost Graver under-deck center-weighted floating roof tank. The typical installations at the left show the obvious advantages of Graver's new clear-deck single roof in all climates.



IT'S TIGHT



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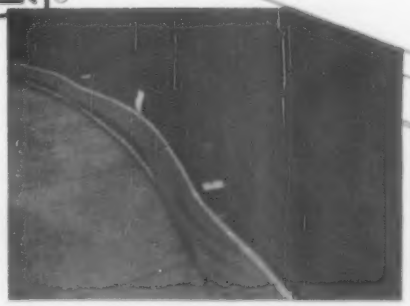
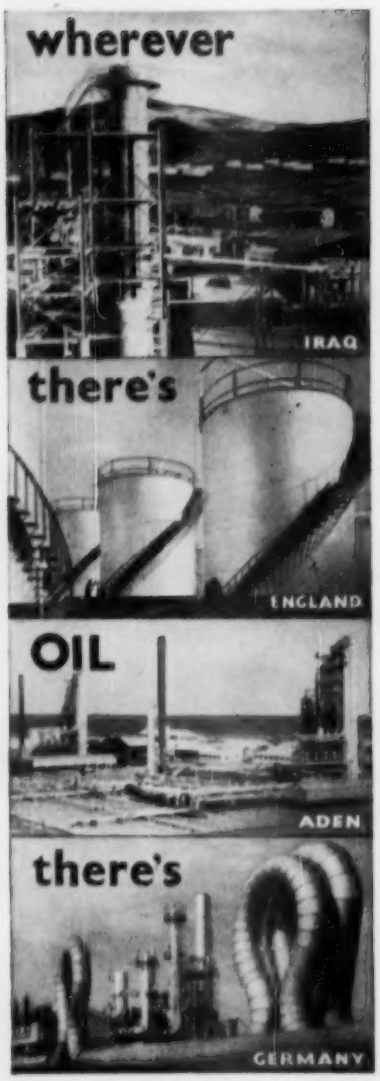
SINGLE VAPOR-STOP SEAL

Graver's patented Vapor-Stop single seal is an inherent feature. This effective seal rides "tight" over weld seams on new construction and rivets on re-roofed tanks.



IT'S FLEXIBLE



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cluded. Performance characteristics and significant features, such as high catalytic activity, physical ruggedness, long operating life, long operating cycles, operating flexibility, yields, and economy factors are completely covered. The bulletin also includes a table showing hydrodesulfurization and color stabilization results achieved in treating a variety of selected feed stocks with G-35 catalysts. **For more information write or call: The Girdler Co., 224 East Broadway, Louisville 1, Ky.**

●

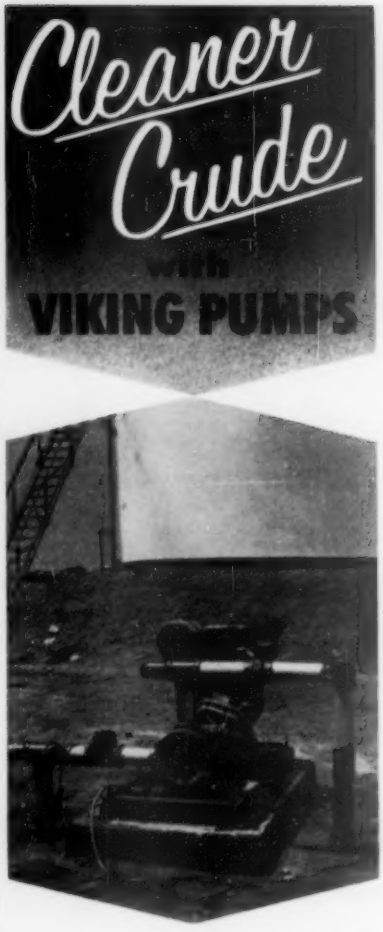
Norelco X-ray for Industry, a new 12-page, 3-color booklet, contains operating and application data on six different types of radiography units. Instruments covered include: 60 kv. potential lightweight portable radiographic-fluoroscopic unit, 160 kv. potential dual-port, 160 kv. potential 360° circumferential-port unit, 150 kv. constant-potential unit, 300 kv. constant-potential unit, and 260 kv. potential self-contained portable unit. The booklet provides information on industrial image intensifier and closed-circuit television installations. Charts indicate instrument selection for various thicknesses of steel and aluminum, shows penetration values of different alloys and metals, and exposure data for steel. **For more information write or call: North American Philips Co., Inc., 750 South Fulton Avenue, Mount Vernon, N. Y.**

●

Thermal-Conductivity Analyzers. The new 16-page Bulletin TD-507 provides information on the practical application and operation of thermal-conductivity analyzers. Complete with photographs, drawings, and diagrams, the booklet offers valuable information to those interested in continuous gas-analysis instruments. **For more information write or call: Arnold O. Beckman, Inc., 1020 Mission Street, South Pasadena, Calif.**

●

Vapor Fractometer, a new gas chromatography instrument, is described in a 16-page, 2-color brochure. The Model 154-B vapor fractometer operates at higher temperatures than its predecessor, the Model 154, has a more sensitive dual thermal-conductivity detector, and includes as standard equipment a solenoid-operated liquid-sample collection outlet. The brochure gives examples of trace analyses possible with it, and discusses its use in conjunction with infrared spectroscopy. It describes the new sampling accessories available for use on the Model 154 as well as on the improved Model 154-B. **For more information write or call: Perkin-Elmer Corp., Norwalk, Conn.**



Viking Pumps pay for themselves many times over in supplying cleaner crude to the pipe lines.

To keep your tanks from settling-out and to provide cleaner crude to the refineries, install Viking crude circulating pumps.

The smooth-flowing Viking pumps mean positive circulating through treaters and separators.

Available in a complete range of sizes for every purpose—35-50-90 gallons per minute as well as others. Send today for catalog Ct.

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Cedar Falls, Iowa, U.S.A.
In Canada, it's "***ROTO-KING***" pumps
SEE OUR CATALOG IN SWEETS

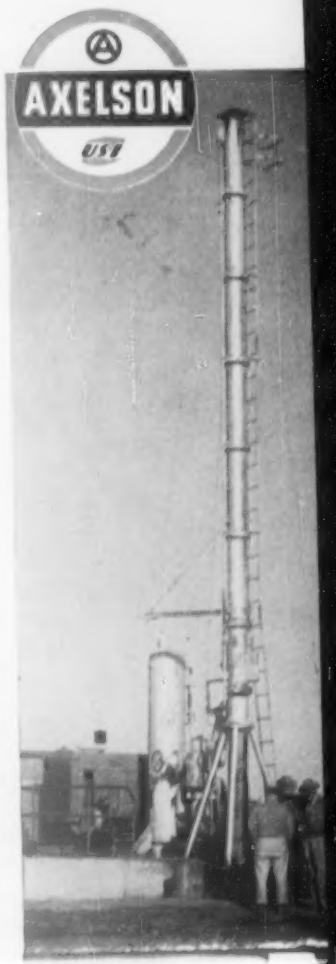
AXELSON PICTORIAL

PROUD FATHERS. This is the backfield for New London High School, Texas. They won the area championship and went on to compete for the state title. In Texas, competition for state honors—well, there's none tougher. The players are all sons of oil men. Left to Right (front row): Jackie Sledge QB, Don Allen FB, Joe Allen HB, Joe Hughes T, Johnny Dickerson QB, Tom McClellan HB, Burna Battles FB. (Back row): Sledge, Humble Oil Company; Allen, Humble Oil Company; Hughes, Sun Oil Company; Dickerson, Humble Oil Company; McClellan, Humble Oil Company; Battles, Atlantic Refining Company. Oilmen also have a championship team in production equipment—Axelson deepwell pumps, sucker rods and hydraulic pumping units.

LEFT TO RIGHT. In front of the Axelson pumping unit (shown at right) are three important members of Leland Fikes' production department: C. W. "Kelly" Lindholm, Lease Foreman; A. D. (Dale) Mortimer, Field Superintendent; Roy Walline, Roustabout. *According to company records, the Axelson unit paid out in nine months.*

960 BPD. This hydraulic pumping unit was installed at Lindsborg, Kansas, May 27, 1951, and was one of the early models built by Axelson. It pumps 960 BPD from 3,300 feet at 6 strokes a minute. A 2¼ Axelson TLE Tubing Pump is at bottom and an Axelson sucker rod string completes the hookup. Axelson Long-Stroke pumping units are recommended for greater production at slower pumping rates, greater depths, less turbulence at well bottom and less wear and tear on subsurface pumps and rods.

TUNESMITH. Making up an RLA pump is Axelson's pump repair crew at the store in Long Beach, California. (Left to right) Bob Campbell, Earl Kirby (Store Manager), Herb Rainbolt. Campbell has written several successful songs for such able performers as Stan Freiburg and others. His latest is "I'll be Kind," recorded at Capitol Records, Hollywood, by a vocal group. Bob is now the new Axelson store manager at Ventura.



A LESSON IN PUMP SERVICE FOR A MAN FROM INDONESIA

Peter C. "Pete" Staats is a Petroleum Engineer for Standard Vacuum Oil Company in Indonesia. The wells under his jurisdiction are in the Lirik Field on the island of Sumatra and although they are presently flowing, they will soon go on the pump. He was born and raised in Holland before his assignment in the Dutch East Indies. Last December he visited the United States to study production techniques in this country, under the direction of D. A. Murphy, District Superintendent for Magnolia Petroleum Company.

At Magnolia's Gunsite Sand Unit Farm near Electra, Texas, Pete saw firsthand how a pump is pulled, repaired, transported and replaced in the well with a minimum loss of time and production. At 9 A.M., the lease foreman called the Jones and Laughlin store in Electra and ordered a pump delivered "right after lunch." The pump in the well was being pulled and was expected to be out just before the lunch hour. The new pump was at the site on time and went back in the well with no loss of rig time. The photographs describe the sequence of events.

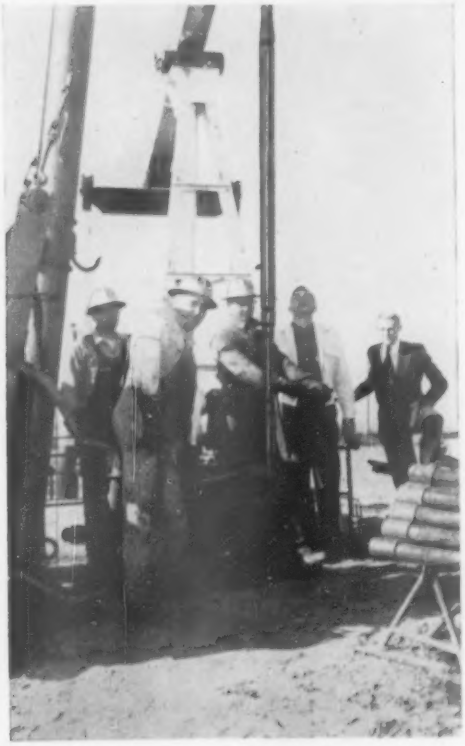
IT BEGINS HERE. While the subsurface pump is being assembled in the shop at Jones & Laughlin's store at Electra, Texas, Joe Fitts (left), the Axelson Representative from Graham, Texas, explains the various combinations of Axelson pumps for virtually every type of oilwell service, while Pete Staats (center) and T. M. Bailey, J & L store manager, listen.

ALL SET. The pump is strapped to the pump rack of Joe Fitts' car by W. E. Cude, Storeman, where it will be delivered directly to the well. Axelson and J & L men carry these car racks for this type of service and it is unusual when they do not put 50,000 miles on a car within a year. They are on call around-the-clock and attend more night and emergency calls than a doctor.

EARLY ARRIVAL. The pump is delivered to the well with time to spare. This is one of Magnolia's portable pulling rigs. Pete meets the members of the crew and listens to their stories while they finish eating lunch. He gathers valuable on-the-scene information he will take back with him to Indonesia.

AXELSON PICTORIAL

OFF SHE COMES. The pump is removed from the car and placed on the tubing rack by three members of Magnolia's well-servicing outfit. Left to right: (lower photo) C. D. Gee, G. R. Walhup, Leroy Cotton. Gee, the gang pusher, has been with Magnolia over 18 years and has handled many an Axelson pump in his time.



MISSION ACCOMPLISHED. The last length of tubing is being made up and the well will soon be on production again. Twenty-six barrels of 40 gravity crude oil are pumped daily from 1,860 feet. Axelson pumps are specially equipped to combat severely corrosive conditions.

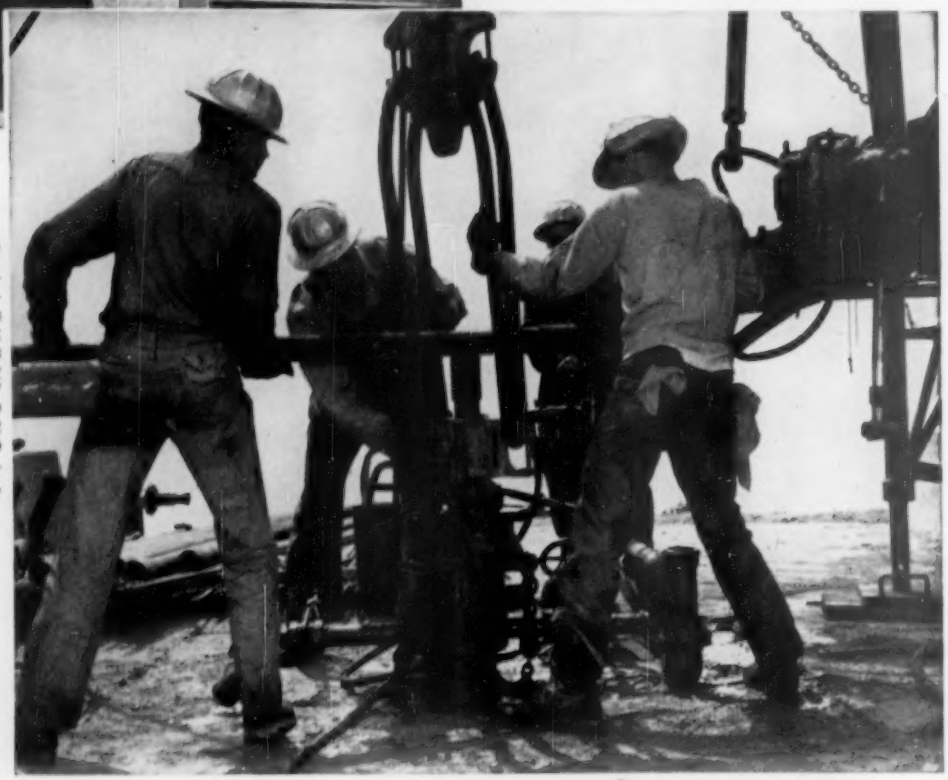
SHORT STROKE. A few miles away near Hollyday, Texas, Pete observes an Axelson Hydrax hydraulic pumping unit in operation for Cities Service Oil Company, while Joe explains its advantages. This is a 6 ft. stroke "Pedestal Mount" Model H100. It is also made with a 10 foot stroke. The Axelson Hydraulic Long Stroke pumping unit (25 ft.) is recommended for greater depths and greater production.

PIPE DOWN. The Axelson pump is being lowered into the well with the first length of tubing while Joe and Pete look on. Joe brought back the pump that had been pulled. The plunger was corroded by electrolysis. New parts were inserted from stock and pump was again ready for active duty.

AXELSON

AXELSON PICTORIAL

PUBLIC DEMONSTRATION. Harold F. Allen, Science Instructor at Coalinga College, California, uses a model of an Axelson RLA (rod-type) subsurface pump to explain the principle of artificial lift to his engineering students. Axelson gladly makes available these model oilwell pumps to schools and colleges for classroom study. A 15-minute demonstration will often save hours of classroom discussion and blackboard diagramming.



TUBING RUN. High on a hill overlooking the blue Pacific at Capitan, California, General Petroleum Corp's well service crew runs tubing back into the well while Hydro-Test runs a simultaneous check for tubing leaks. Equipped with an Axelson 2" RLB Pump and Axelson ⅞" #59 Sucker Rods, this well makes 12 B/D of 28 gravity crude from 2,600 ft. (l. to r.) Edwin Bruce, June Garland, Burl Hankey (Gang Pusher), Cecil Sutton.

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Specify **AXELSON** *for*
Subsurface Pumps
Sucker Rods
Hydraulic Pumping Units
Stuffing Boxes & Packing
for better production

Where to buy Axelson Production Equipment:

CALIFORNIA: *Axelson stores at Bakersfield, Coalinga, Huntington Beach, Long Beach, Orcutt, Santa Fe Springs, Taft, Ventura; Hickey Pipe & Supply Co. (Sucker Rods)* • **MID-CONTINENT:** *Jones & Laughlin Steel Corporation, Supply Division (Headquarters, Tulsa)* **ROCKY MOUNTAINS:** *Jones & Laughlin Steel Corporation, Supply Division; Great Northern Tool & Supply Co., Billings, Montana* • **CANADA:** *Jones & Laughlin Steel Sales Co. Ltd., Calgary; Dominion Oilfield Supply Co. Ltd., Calgary* • **MEXICO, D. F.:** *Wells Fargo & Co. Express, S. A.* • **RIO DE JANEIRO, BRAZIL:** *MAQUIP (Commercial de Maquinas e Equipamentos) S. A.* • **LIMA PERU:** *Gross Equipment, S. A.* • **LA PAZ, BOLIVIA:** *Del Prado & Compania, Ltd.* • **BUENOS AIRES, ARGENTINA:** *Adrian Bolland & Cia., S. R. L.* • **BARCELONA, VENEZUELA:** *Servicios Industriales, C. A.* • **MARACAIBO, VENEZUELA:** *Servicios Industriales, C. A.* • **BOGATA, COLOMBIA:** *Servicios Industriales, C. A.* • **TRINIDAD, B. W. I.:** *Industrial Agencies, Ltd.*

Where to buy Axelson Hydraulic Pumping Units:

CALIFORNIA: *Axelson stores (see above)* • **ODESSA:** *Axelson Warehouse* • *Industrial Supply Company stores at* **DALLAS, ELECTRA, FORT WORTH, FREER, HOUSTON, KAMAY, MIDLAND, ODESSA, SAN ANTONIO, SNYDER, TULSA, TURNERTOWN, WICHITA FALLS** • *Mountain Iron & Supply Company stores and offices at* **ANTHONY, AUGUSTA, BARTLESVILLE, DENVER, GREAT BEND, INDEPENDENCE, KIMBALL, LEROY, MADISON, McPHERSON, PARKERSBURG, PLAINSVILLE, RUSSELL, TULSA, WICHITA** • *Export (See above).*

EQUIPMENT MEN . . . in the News

Beaird Promotes Two In Compressor Sales

John W. Hendryx has been promoted from sales engineer to product sales manager for packaged compressors, and J. E. Kelly, formerly service engineer, has been named chief service and office engineer for The J. B. Beaird Co., Inc. The announcement was made by J. L. Tullis, vice president and general manager of sales.

J. W. HENDRYX

J. E. KELLY

Hendryx and Kelly will continue to work with W. W. Sentell, manager of the compressor sales division, in expanding the market and service facilities for Beaird-Ingersoll-Rand packaged compressor plants.

Hendryx, who has been with Beaird since 1951, has worked as both design and sales engineer. Kelly joined Beaird in 1950 as an inspector, moving up to junior engineer, then service engineer before his present promotion.

Lane-Wells Names Stewart To Head El Dorado Sales

Robert H. Stewart has recently been appointed to head the sales department of Lane-Wells Co. technical oil-field service for the El Dorado, Ark., area, according to Ed Saye III, Mid-Continent sales manager. Stewart is replacing Tom Bush, who has been promoted to the company's Wichita, Kans., office.

Stewart worked for Lane-Wells while attending university. Following naval service, he worked in various phases of the petroleum industry before rejoining Lane-Wells.

Orbit Valve Managers Attend Sales Meeting

Orbit Valve Co. recently held a 3-day sales meeting at Tulsa for regional and district managers. Orbit's key field men met with executives for a conference reviewing progress and hearing plans outlined for the future.

President Ed D. Ligon reviewed Orbit Valve's past growth and detailed future plans. Don Blevans, vice president in charge of engineering and manufacturing, discussed product improvements scheduled for early adoption.

J. Dock Mumford, vice president in charge of sales, and Sales Manager Ed Wallace conducted panel discussions emphasizing customer viewpoint on product and field service. The meeting also included a plant tour for study of manufacturing facilities, production equipment, and methods.

Standing: Ed D. Ligon, president; L. E. Wallace, general sales manager; J. Dock Mumford, vice president; Charles J. Folger, regional manager, Mid-Continent and eastern states; Jack H. Hancock, district manager, Rocky Mountain area.

Seated: H. C. Sawyer, regional manager, West Texas and southern New Mexico; James P. Bowling, district manager, North and East Texas and North Louisiana; Ralph H. Soape, district manager, Gulf Coast area; Claude W. Brown, district manager, Oklahoma and Kansas.

Mid-Continent Announces Domestic, Foreign Changes

Mid-Continent Supply Co.'s President Ken W. Davis recently announced personnel changes affecting 27 men in the company's operations in the United States, Canada, and South America.

J. P. Jones has been named assistant to general manager of sales and has been moved to Fort Worth. W. A. Sellers recently assumed duties as assistant to general division manager.

J. P. JONES

W. A. SELLERS

R. S. WEILMAN

E. E. CAMPBELL

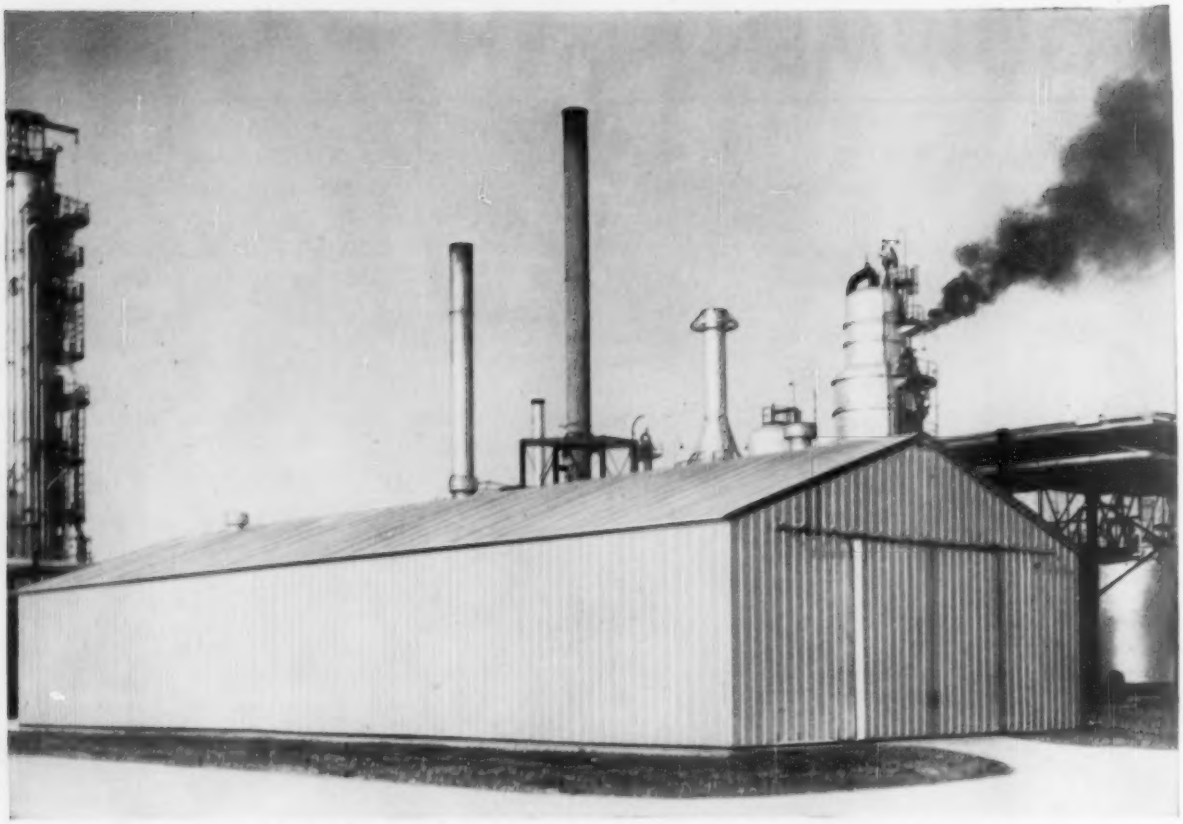
W. M. DAY

J. W. EASTHAM

R. S. Weilman, former New Orleans district manager, is now Gulf Coast division manager, and E. E. Campbell has been named division machinery manager at Midland, Tex. W. M. Day recently assumed duties as assistant division sales manager at New Orleans.

The Odessa district has been divided. J. W. Eastham, former Brownfield district manager, has been named Odessa district manager, and M. L. Hancock manages the new Hobbs, N. M., district. Bill Thornton has been placed in charge of the Abilene, Tex., district and A. L. Murry the Wichita Falls, Tex., district.

Other men promoted to district man-



Butler storage building 100 feet by 40 feet. Offers maximum storage area in a quality building that is modest in cost.

Here's why you can order **Butler** *metal buildings from stock*

Butler metal buildings are America's most popular metal buildings. Their quality made them popular—and their popularity makes it possible to carry large inventories. For this reason, you can order the exact Butler building you need right out of inventory from the world's most complete selection of sizes.

Erect it with your own crews, or use your Butler Builder's team of construction specialists. Your Butler building is pre-engineered, pre-punched and pre-fitted for quick, accurate assembly.

No field flashing is required. All Butler panels are die-formed for precision fit which includes one-piece corners and one-piece roof ridge. They bolt into a one-piece steel structure that is impervious to wind, rain or snow. It is attractive, permanent and requires practically no maintenance.

Throughout the gas and oil industry, you can see Butler metal buildings at work as pump houses, garages, reclamation shops, field offices, gas compressor stations—in short, wherever a low cost, high quality building is required.

Butler building used as an oil tool supply store. Note how the attractive front adds to its commercial appeal.

For more information on how to build a quality building faster, phone your Butler Builder. His name is listed under "Buildings" in the yellow pages of your telephone directory. Or write direct for brochure, "Butler Steel Buildings for the Oil Industry."

BUTLER STEEL PRODUCTS

BUTLER MANUFACTURING COMPANY

7464 East 13th Street, Kansas City 26, Missouri

Manufacturers of Steel Buildings • Oil Equipment • Farm Equipment • Dry Cleaners Equipment • Outdoor Advertising Equipment • Special Products

Sales offices in Los Angeles, Richmond, Calif. • Houston, Tex. • Birmingham, Ala. • Minneapolis, Minn. • Chicago, Ill. • Detroit, Mich. • Syracuse, New York City, N. Y. • Washington, D. C. • Burlington, Ont., Canada

ager are R. E. Dunn at Wichita, Kans.; T. R. Fleeman at Brownfield; and J. O. Ramsey at New Orleans.

M. L. HANCOCK

BILL THORNTON

Included also in Mid-Continent's district expansion are the promotions of R. W. McDaniel to district machinery

A. L. MURRY

R. E. DUNN

manager at Edmonton, Alta.; W. R. Shuffield to district sales representative at New Iberia, La.; and B. J.

T. R. FLEEMAN

J. O. RAMSEY

Shipman to district sales representative at Oklahoma City.

R. F. Timmons has been moved from Denver to Mid-Continent's export division at New York City as sales representative. In Caracas, J. W. Davis has assumed new duties as Venezuelan manager.

B. J. Dickey recently moved from Newcastle to Estevan, Sask., where he heads operations of Mid-Continent's mobile field supply store. Construction is scheduled to begin soon on a permanent field supply store at the Estevan location.

Nine men have been made manager of field supply stores. F. C. Burkett was named store manager at Wichita Falls, Tex.; J. R. Cunningham at Magnolia, Ark.; R. H. Goodwin at Bowie, Tex.; F. D. Groves, Eunice, N. M.; L. O. Lilly, Sundown, Tex.; R. H. Martin, Hobbs; H. E. Rydell, Andrews, Tex.; R. E. Shannon, Great Bend, Kans.; and R. R. Thomson, Plainville, Kans.

Motorola Expands, Moves West Coast Headquarters

Motorola Communications & Electronics, Inc., recently announced that it is moving its West Coast headquarters from San Mateo, Calif., to a new and larger building in Millsdale Industrial Park, Burlingame, Calif.

Donald F. Brickley, vice president and western divisional sales manager of Motorola, said that the 10,000-sq. ft. Burlingame facility should be completed by November 15. It will house the parts and service department and double the previous office area.

Besides the divisional sales manager and staff including the local regional manager and radio communications engineers, the divisional service manager and divisional comptroller and the western sales manager for consumer products division will have headquarters in the new building.

Boyd Joins Treco as Administrative Assistant

Ralph M. Boyd recently assumed his duties as administrative assistant to the executives of The Refinery Engineering Co. of Tulsa, according to T. M.

HAPPY FAMILIES on a Prairie . . .

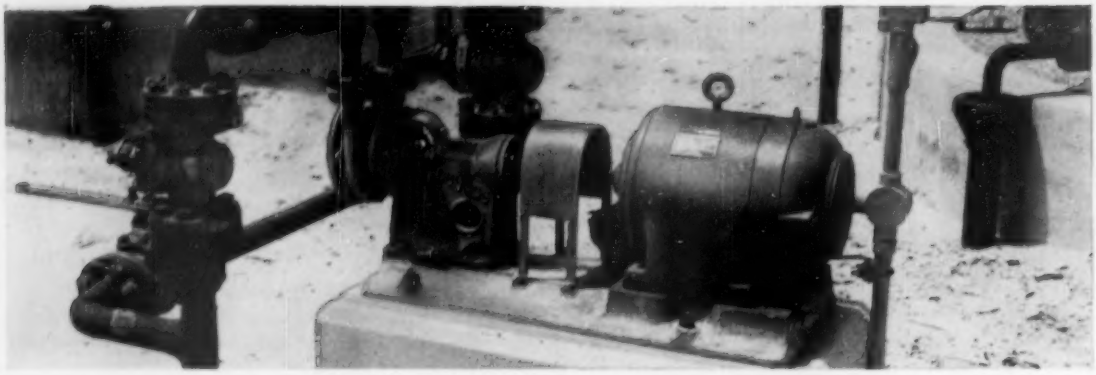
This photograph might have been taken in a new suburban section of a large city. But, it wasn't. This community is miles from any town, and is located at a gas pipe line booster station in Louisiana. These are modern STURDYBILT Prefabricated Homes, planned and designed by our staff architect for the utmost in comfort and livability.

When you need modern housing at reasonable cost, investigate buying or leasing STURDYBILT Houses.

STURDYBILT PREFABRICATED, DEMOUNTABLE HOUSES

SOUTHERN MILL & MANUFACTURING CO. • TULSA, OKLAHOMA

STURDYBILT HOUSES COMPLY WITH COMMERCIAL STANDARD CS125 OF THE NATIONAL BUREAU OF STANDARDS FOR PREFABRICATED HOMES



Salt water won't hurt **this** pump!

It's an *aluminum-bronze* pump that hasn't a trace of zinc

You can handle salt water safely with the Goulds Fig. 3715 because *it's built to take it!*

This Fig. 3715 was designed especially to resist corrosion, abrasion, and dezincification. Its aluminum-bronze construction offers you long-life service under the severest operating conditions. (The pump is also available in Type 316, Gould-A-Loy 20 stainless steel, all iron or bronze-fitted.)

You can cut down on your maintenance problems, too. Impeller clearance can be adjusted *without* dismantling the pump. And you don't have to stock a host of parts—the interchangeability of parts among the ten sizes keeps your inventory at a minimum.

Capacities of Goulds Fig. 3715 are as high as 720 GPM; heads up to 200 feet. Learn more about this remarkably durable pump from your nearest Goulds representative.

Or write direct. Ask for Bulletin 725.4.

MEMBER — Goulds PUMPS INC. Seneca Falls New York

Sales Offices: Atlanta • Boston • Chicago • Houston • New York • Philadelphia • Pittsburgh • Tulsa

First choice of operators the world over for retrieving lost sections of drilling or tubing string

The Bowen "Grapple Grip" Principle

Series 150 Overshot Dressed with Spiral Grapple and Parts

Series 150 Overshot Dressed with Basket Grapple and Parts

SERIES 150 (single bowl) BOWEN Releasing and Circulating OVERSHOT

Series 150 (Single Bowl) Bowen Releasing and Circulating Overshots are compact units made up of a Top Sub, a Bowl, and a Guide. They can be dressed with standard parts to engage and pack off a specific maximum size or with undersize parts to engage and pack off any smaller sizes.

SIMPLE AND EASY TO DRESS: If the O.D. of the fish is close to the maximum catch of the Overshot, only three parts are required to dress it to engage and pack off. If the O.D. of the fish is somewhat below the maximum catch of the Overshot, only two parts are required to dress it to engage and pack off.

SETS AND RELEASES TO THE RIGHT so fishing string is never turned in unscrewing direction—a vital safety point.

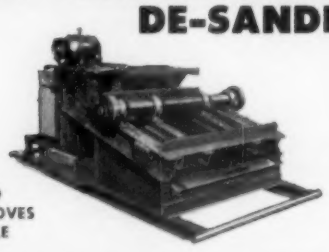
POSITIVE GRIP—POSITIVE RELEASE. The greater the pull, the tighter the grip—yet in releasing operation Grapple will expand and actually let go of the fish.

Write for Descriptive Literature

SR BOWEN CO

ALWAYS IN OPERATION WHEN PUMPS ARE RUNNING

NEW MODEL RUMBA DE-SANDER



ALSO REMOVES SHALE

HUTCHISON MANUFACTURING CO.

6609 AVENUE U HOUSTON 11, TEXAS

Lumly, president. He will serve as coordinator on special assignments.

Boyd comes to Treco from the Tidewater refinery at Drumright, Okla., where he had been manager since 1949. He was first employed by Tidewater as chief chemist in 1928. Prior to that, he had been associated with Standard Oil Co. of Indiana.

Hare Heads Baker Oil Tools Branch at Patterson, La.

W. C. Hare has been appointed branch manager at Baker Oil Tools, Inc.'s, new branch warehouse and office at Patterson, La. Hare was formerly service engineer at Houma, La.

Daniels, Russell Join Harbison-Fischer Sales

James Daniels and Earl Russell have been assigned as representatives for the Graham and Abilene territories of Harbison-Fischer Manufacturing Co., Fort Worth, Tex.

JAMES DANIELS

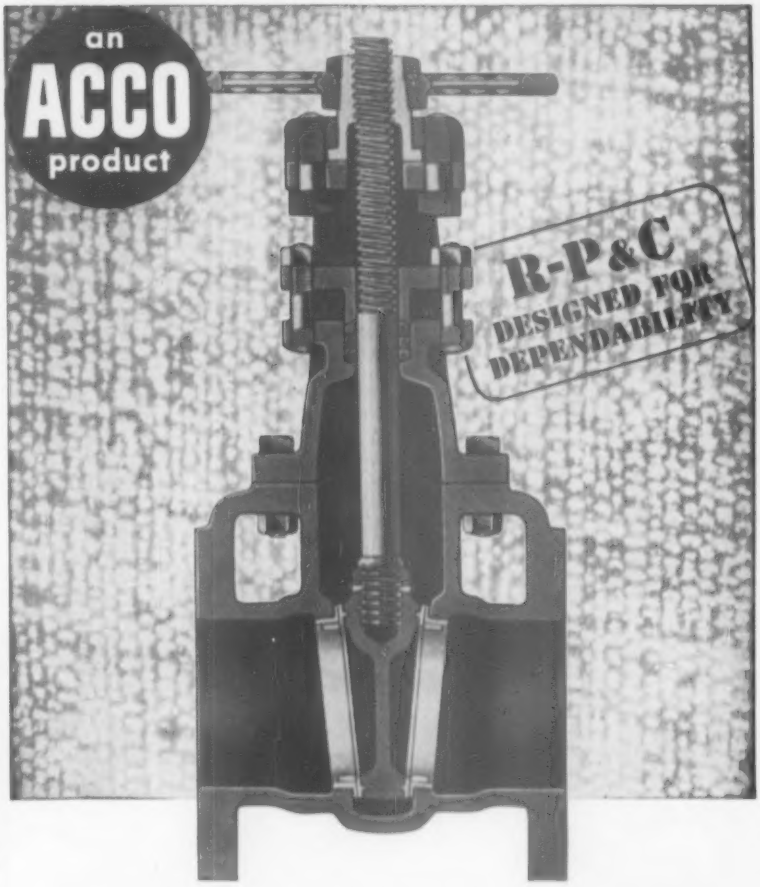
EARL RUSSELL

Daniels will make his headquarters in Graham and work the Jacksboro, Olney, Breckenridge, Cisco, Eastland, and Throckmorton areas. Russell will make Abilene his headquarters and cover Albany, Cross Plains, Coleman, Ballinger, and Winters.

Homco Opens New Outlets, Begins Houston Building

Houston Oil Field Material Co. has opened a new supply store in Liberty, Tex. In Houston the company is erecting a 50 by 100-ft. building which will house an enlarged fishing and cutting-tool department. Additional machinery is being installed to provide faster delivery of manufactured items. Recently, Homco placed a complete line of directional drilling tools and subsurface surveying equipment in the Harvey, La., branch. J. A. (Buddy) Carroll is the directional drilling district manager.

Recently supply stores have been opened at Andrews and Carrizzo Springs, Tex., Kimball, Neb., Morgan City, La., a representative located at Billings, Mont.; service tool outlets at Hattiesburg, Miss., and Oklahoma City;



Wedge Gates from 2" to 24"

—FROM R-P&C's COMPLETE LINE OF IRON BODY VALVES

• Thousands of these Fig. 625 iron body wedge gate valves, in hundreds of different services, are giving the dependable economical service which has come to be synonymous with R-P&C. Rated for 125 lbs. Steam—200 lbs. OWG in sizes up to 12", and for slightly lower pressures in larger sizes, they are regularly furnished with bronze trim for use with steam, water, oil or gas. Also provided in all-iron for use with fluids which attack bronze.

• Their record for dependable service and low maintenance requirements is shared by R-P&C's complete line of iron body valves—gates, globes, angles, checks and cocks in a complete range of sizes, body styles and pressure classes up to 250 lbs. All are made from castings of special fine-grained, high test, cast iron —50% stronger than ordinary cast iron. Precision manufacturing and step-by-step quality control result in tight closures, easy operation and longer wear.

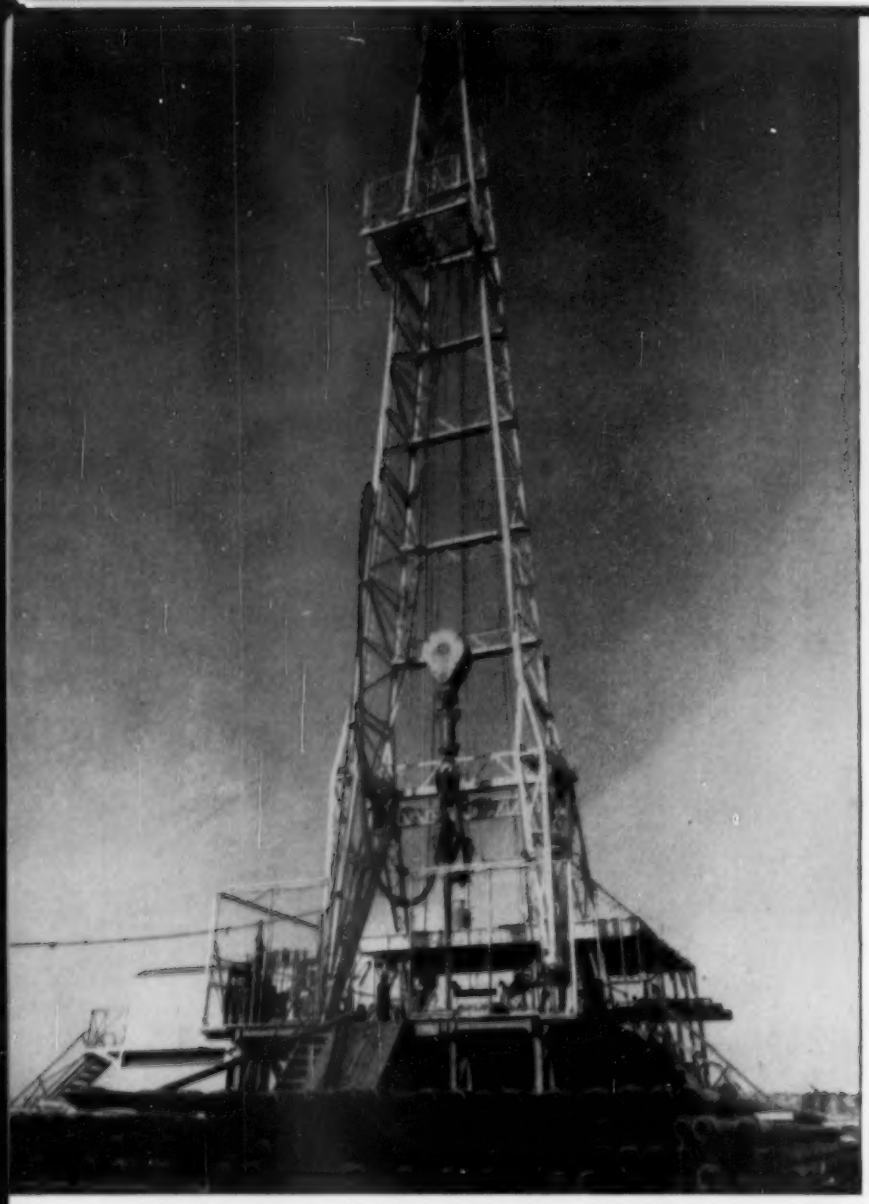
See your R-P&C distributor or write for catalog

ACCO

R-P&C Valve Division
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

R-P&C valves

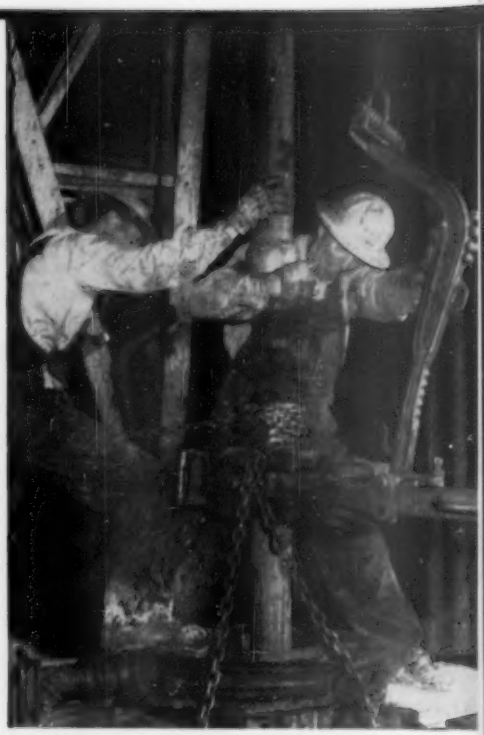


Designed for speed in drilling, this rig drilled 7,400 ft in 16 days at a location near Lindsay, Oklahoma. Carrying 40,000 lb of weight at the bit, it was pumping 641 gallons of mud a minute at 1,800 lb pump pressure to pulverize sand and rock and increase the drill's boring speed.

Power-Play For Oil

Mercury Drilling Company—searching for new reserves —uses one of the most powerful rigs ever built to thrust Pittsburgh Steel Company drill pipe into the earth.

Packing all the controlled power of a diesel locomotive, Mercury Drilling Company's Rig No. 2 is a giant among the nation's rotary drill rigs. This herculean rig, with its 142-ft high derrick now working in the oil-laden Golden Trend sands of Oklahoma, can bore its jet bits into the earth at rates up to 1,000 ft a day. It can bullseye a one-foot diameter target more than three miles underground.



Roughnecks stab the tool joint into the waiting end as another length of drill pipe goes into the hole.

Equipped with three 870 hp engines and three of the largest torque converters built, it can supply more than 2,400 hp to drive the rotary table and mud pumps. Its block, weighing nearly 8 tons, was specially designed for the rig.

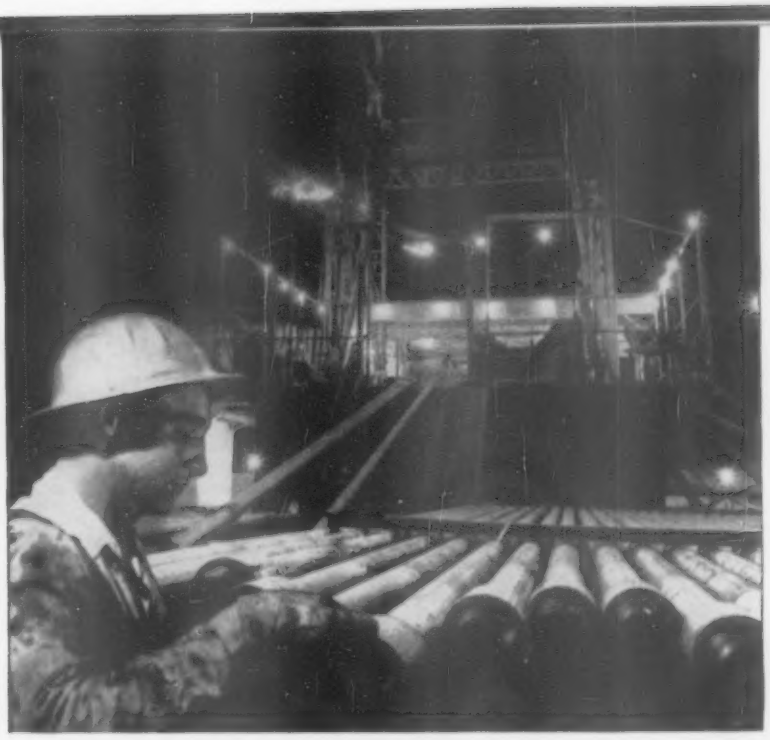
Compact design throughout and a portable mud tank system give the rig mobility. On completing a hole, it can be knocked down, transported to a new location, set up and be drilling again in less than 2½ days with favorable weather.

When you have an investment of over a half-million dollars and operation costs up to $1,000 a day on a rig such as this, you can't afford to waste time.

Every feature of Mercury No. 2 is built for speed. From the power needed to carry heavy bit weight-loads, to the automatic slips for going in and out of the hole, it is equipped to drill more footage faster and more efficiently. Its mobility reduces down time between jobs.

Quality of the equipment and swift supply service are also essential to reaching pay fast. Here again Mercury saves time and expense.

This rig with all its equipment —including Pittsburgh Steel Company's seamless 4½ in. OD



Drill pipe, being measured in the rack, is fed into the hole length by length as the hole deepens. On a rig such as this it must withstand severe tension, compression, torsion and fatigue stresses as well as abrasive wear.

Grade E Range 2 drill pipe—is supplied by one of the independent distributors listed at right. Already a pace setter, it is hungrily churning after new footage records.

When operations must move fast, oil men with a lot at stake prefer the services of these distributors. Here's why:

Independent distributors are ready for action. Even the smallest item of equipment is available to your rig 24 hours a day, seven days a week. Well-stocked supply stores mean equipment can be on hand at the rig with least delay. You can count on them in emergencies.

Their service is flexible. The independents are personal friends to oil men they serve. Through long experience, they know the problems and can meet requirements without red tape and extra paper work. They are free from remote control and can make big decisions without wasting time.

Independent distributors help keep costs low. With all the extra service available, they keep their prices competitive. They can do this because of low overhead, and because their livelihood depends on meeting competition. The return Mr. Independent makes in business stays at home.

Their equipment is the best. Being independent, these distributors are free to select from the best equipment made, on the basis of performance and customers' requirements. They are backed by reputable manufacturers—such as Pittsburgh Steel Company, a producer of high quality seamless oil country goods for more than half a century.

Independents are accessible. The distributors at right have 141 stores covering all major oil fields in this country and some abroad. Yet each distributor individually concentrates his services in the home areas he is best qualified to serve.

Next time you need a string of drill pipe, casing or tubing, get the pipe of your choice through the distributor of your choice! Specify Pittsburgh Seamless!

For Fast, Personal Service

— these independent distributors who carry Pittsburgh Seamless drill pipe, oil well tubing, and casing are ready to meet your requirements.

Home Offices

Bradford Supply Company
130 Main Street
Bradford, Pennsylvania

Buckeye Supply Company
18 Harrison Street
Zanesville, Ohio

C. W. Cotton Supply Company
Utica National Bank Building
Tulsa 5, Oklahoma

Franklin Supply Company
624 South Michigan Avenue
Chicago 5, Illinois

Houston Oil Field Material Co.
1524 Maury Street
Houston, Texas

Industrial Supply Company
500 Eighth Street
Wichita Falls, Texas

Iverson Supply Company
400 West Fifth Street
Tulsa, Oklahoma

Lucey Export Corporation
233 Broadway
New York 7, New York

Lucey Products Corporation
624 South Cheyenne
Tulsa 19, Oklahoma

McJunkin Corporation
P. O. Box 513
Charleston 22, West Virginia

Midland Supply Company
Box 3105
Washington St. Station
Wichita 7, Kansas

Mountain Iron & Supply Co.
100 Rule Building
Wichita 2, Kansas

Murray Brooks, Incorporated
P. O. Box 855
Lake Charles, Louisiana

Producers Supply & Tool Co.
706 Commercial Standard Bldg.
Fort Worth 2, Texas

Rodman Supply Company
P. O. Box 2752
Odessa, Texas

Southwest Supply Company
1720 Oliver Building
Pittsburgh, Pennsylvania

Superior Iron Works & Supply Co.
P. O. Box 1800
Shreveport, Louisiana

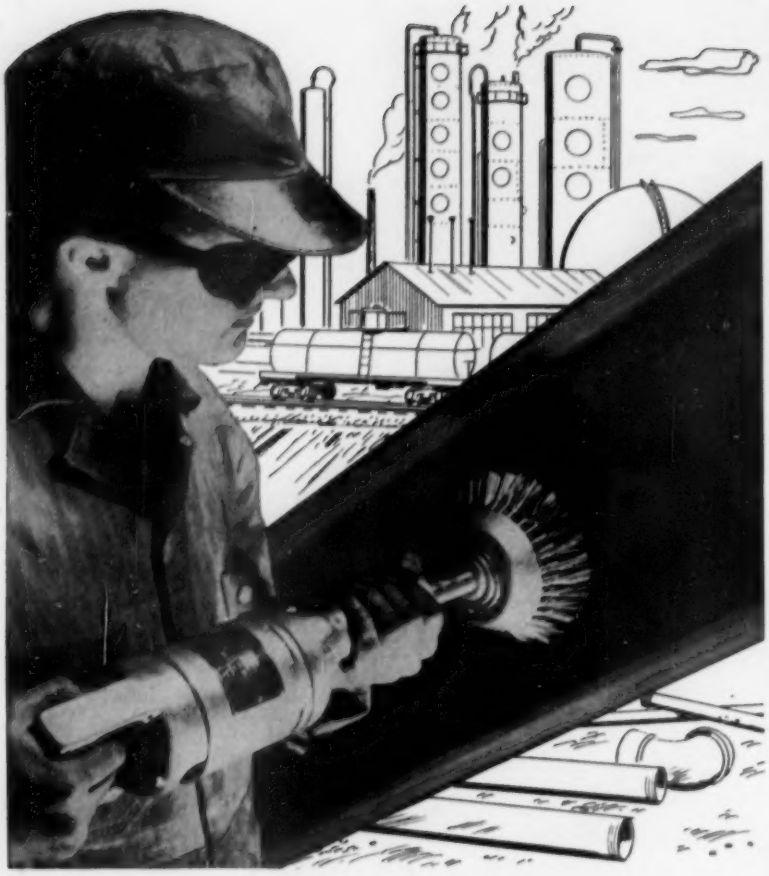
Western Supply Company
424 North Boulder Avenue
Tulsa 1, Oklahoma

Pittsburgh Steel Company

Grant Building • Pittsburgh 30, Pa.

District Sales Offices

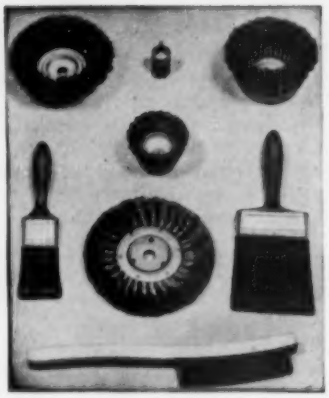
Atlanta	Columbus	Detroit	New York	Tulsa
Chicago	Dallas	Houston	Philadelphia	Warren, Ohio
Cleveland	Dayton	Los Angeles	Pittsburgh	



Big jobs are easy jobs

HIGH speed Osborn power brushes take all the effort out of cleaning rust, scale and old paint from large metal surfaces. Rugged, special analysis wire quickly bites through the most stubborn rust and other surface crusts . . . keeps brushes in service longer.

For information on Osborn's complete line of top-quality industrial brushes, write for Catalog 210-B. *The Osborn Manufacturing Company, Dept. N-15, 5401 Hamilton Avenue, Cleveland 14, Ohio.*



Osborn has a brush to meet every industrial need—power, paint or maintenance . . . and you get quality automatically when you specify "Osborn".

Osborn Brushes

OSBORN BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

supply and service outlets at Lafayette, La., and Sherman, Tex.; an export office at New York City, and an export sales office at Mexico City.

Louisiana Offshore Group Formed by Magcobar

R. E. HINCHLIFFE

Formation and activation of a Louisiana offshore division of the drilling mud department of Magnet Cove Barium Corp. has been announced by Frank Loe, manager of drilling mud sales. The new division is comprised of specialized service engineers. It is in addition to existing service.

The Louisiana offshore division is under R. E. (Rags) Hinchliffe, formerly Fort Worth division manager, and is headquartered at Lafayette, La. It consists of three new districts: District 16 at Lake Charles, with Bill Glasspool as district manager; District 17 at Houma, with Robert L. Vannoy as district manager; and District 19 at New Orleans, with Ken Begley as district manager.

Drilling operations offshore Texas will continue to be serviced by the Gulf Coast division under C. H. Sydow, Jr.

Neal Joins Ross-Martin As Account Executive

N. E. NEAL

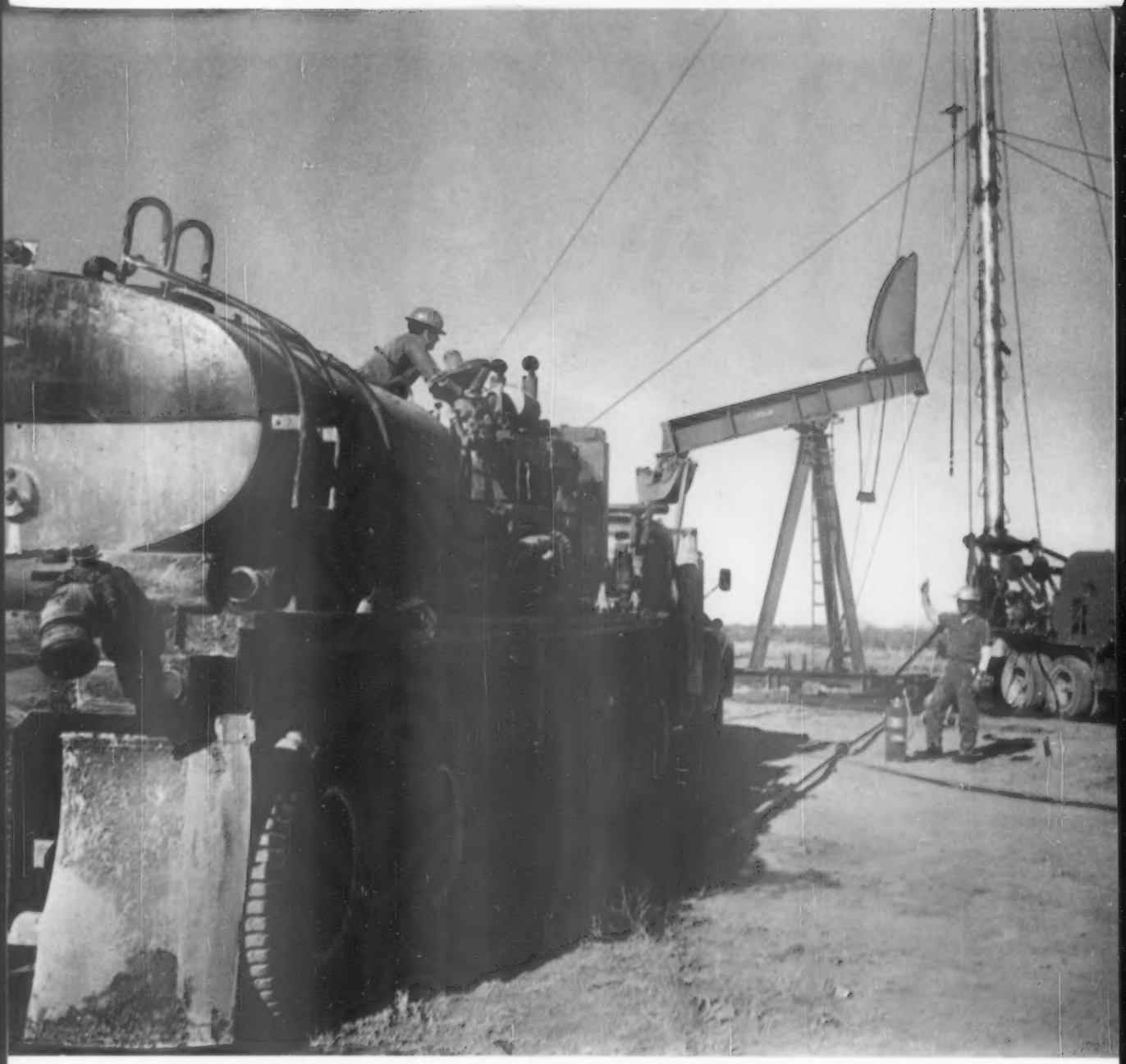
Nevin E. Neal, former assistant dean, downtown division of the University of Tulsa, has joined Ross - Martin Co. of Tulsa. Neal will be account executive in the forms management service division, performing paper - work control programs in nationwide concerns.

Neal has been associated with the University of Tulsa since 1946.

Twin Disc Clutch Appoints Ellison to Tulsa Office

The appointment of Jimmie C. Ellison as district representative in charge of the Tulsa office has been announced by N. F. Adamson, vice president of sales, Twin Disc Clutch Co., Racine, Wis.

Ellison fills the vacancy created by



Dowell engineers use specialized pumping equipment capable of delivering the volumes and injection rates you need.

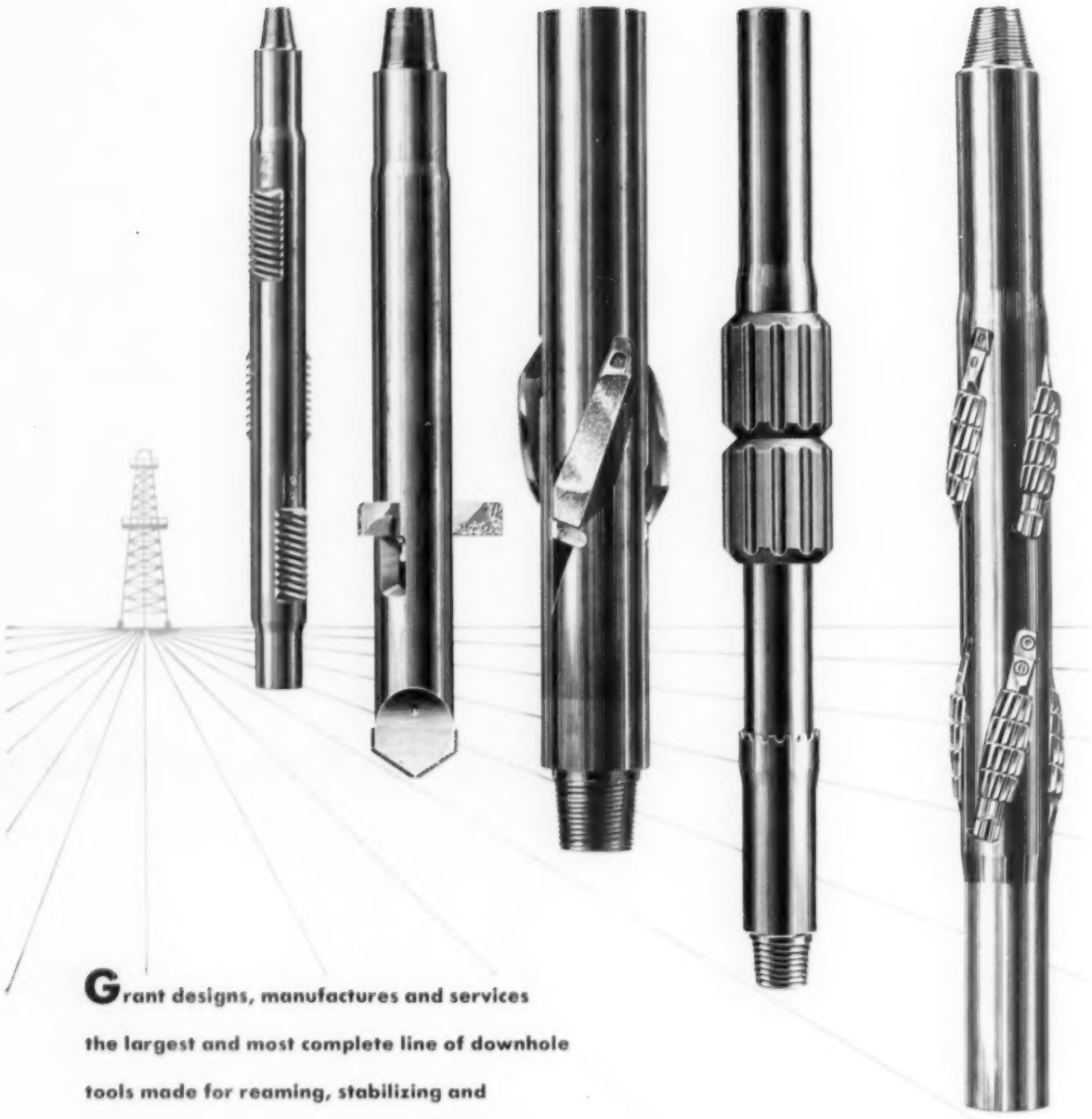
How do you like your acid?

There wasn't much choice of materials when Dowell pioneered oil well acidizing 24 years ago. All you could get was plain inhibited hydrochloric acid.

Today it's a different story. Skilled engineers use a variety of Dowell-developed materials to tailor acidizing to your well, for example: high-temperature inhibitors; temporary plugs; retarded acid; non-emulsifying, low surface tension and silicate control additives. What's more, these engineers use highly specialized pumping equipment and are backed by Dowell's 24 years of oilfield experience. These are the *extras* you get when you call Dowell for acidizing services.

services for the oil industry **DOWELL**

A Service Subsidiary of The Dow Chemical Company
DOWELL INCORPORATED • TULSA 1, OKLAHOMA



Grant designs, manufactures and services the largest and most complete line of downhole tools made for reaming, stabilizing and hole conditioning . . . available everywhere to help you drill better wells, for less.

GRANT
OIL TOOL COMPANY

- **CALIFORNIA:** Avenal • Bakersfield • Compton • Ventura
- **LOUISIANA:** Harvey • Lafayette
- **NEW MEXICO:** Hobbs
- **OKLAHOMA:** Oklahoma City
- **TEXAS:** Houston • Odessa
- **EXPORT:** 17 Battery Place, New York 4, N. Y.

the appointment of M. H. Woodward as assistant vice president of Twin Disc Clutch, Germany. Woodward's appointment is part of a Twin Disc move toward expanding its international sales program.

For 5 years prior to joining Twin Disc in 1955, Ellison was a special project engineer with Unit Rig & Equipment Co.

Power Chief Distributor Named by Nordberg

Appointment of Diesel Engine & Equipment Service Co. as distributor of Power Chief diesel engines in 19 counties in southeastern Texas is announced by Nordberg Manufacturing Co. Sales and service facilities of the company are in Houston.

Diesel Engine & Equipment's building has 5,000 sq. ft. of floor space and contains offices, a showroom, parts department, and a completely equipped shop. The firm operates four field-service trucks and is equipped to provide complete engine-repair services in oil fields.

Ralph Austin is president and general manager of the firm. Cecil Brown is vice president and shop manager and Joe Pena is parts manager.

Witte Engine Is Host to Oilwell Officials, Engineers

Some 45 officials and sales engineers of U. S. Steel's Oil Well Supply Division from the United States and Canada gathered recently at the division's Witte Engine Works, Kansas City, Mo., for a 2-day sales-promotion meeting.

K. O. Nilsson, Witte general manager, said the purpose of the conference was to bring the sales representatives up to date on the plant's oil-field engine models, acquainting them with recent developments and plans for the future. During the meeting the visitors viewed production lines, and operation and laboratory testing of the various models, in addition to discussions of sales features.

Hosting the meeting, besides Nilsson, were J. M. Hall, manager of oil-field sales, and the plant's engineering and production sections. Heading the list of visitors were four officials from Oil Well Supply's Dallas, Tex., headquarters: Alex Quayle, director of engineering; J. M. Haynes, manager of engine and compressor sales; J. S. Fuller, manager of production equipment sales; and William Miskimins, manager of Oilwell's central Midwest area.

Executives at Oilwell's sales-promotion meeting are: J. M. Haynes, manager of engine and compressor sales, Dallas; K. O. Nilsson, Witte general manager; C. L. Schwab, district representative from Bakersfield, Calif.; Alex Quayle, director of engineering, Dallas; and J. M. Hall, Witte's oil-field sales manager.

diamonds . . . crown jewels for drilling

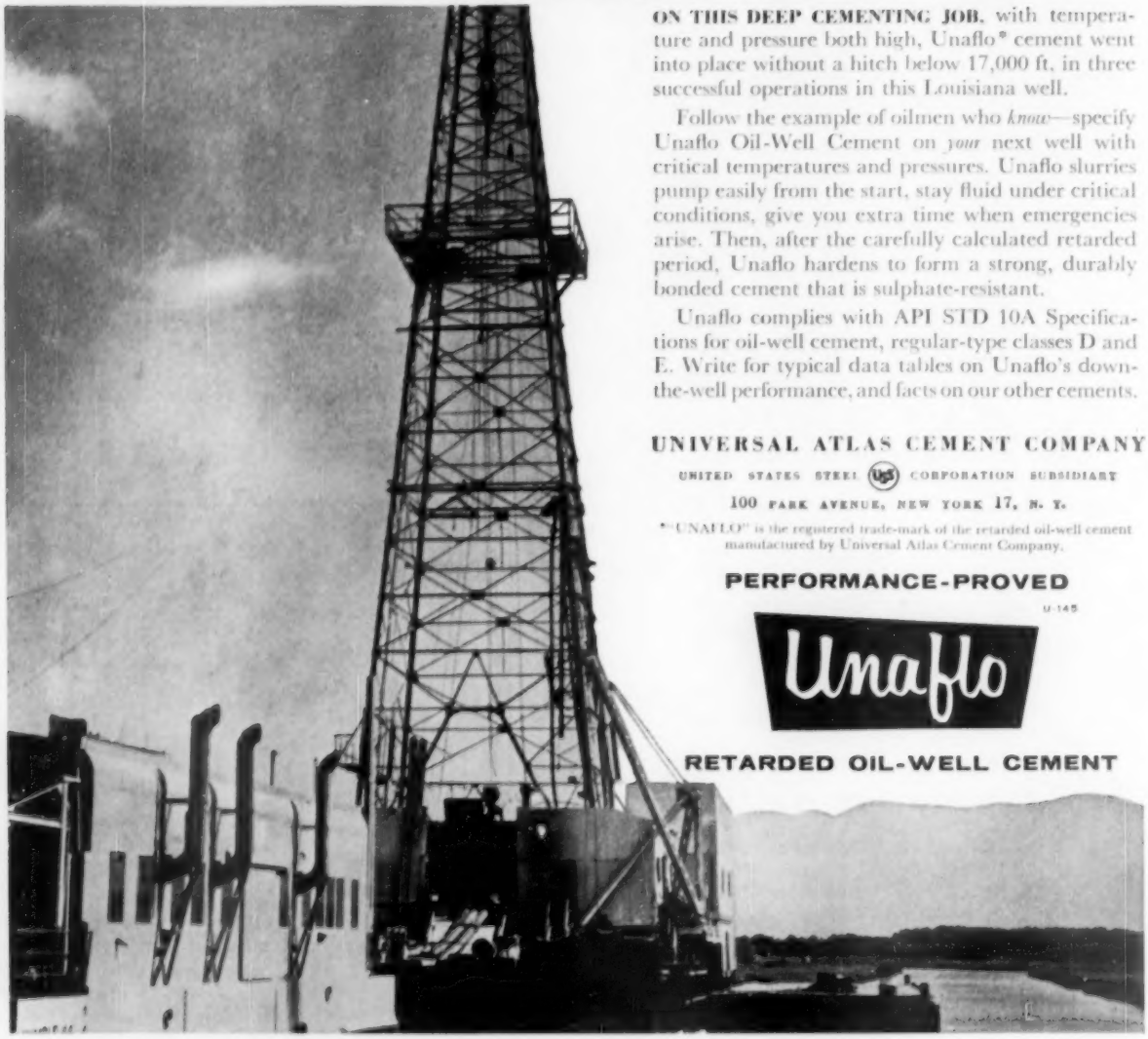
D&S and Truco diamond coring and drilling equipment has fast earned the reputation of the Royal Family in the oil field. Oil operators are realizing royal savings, too, because of faster coring and drilling penetration, cleaner holes, core recoveries at any strata, and time and money saved on every job. Write or call today! A D&S sales engineer is ready to analyze your diamond needs and explain the many D&S advantages.

Drilling & Service

DIAMOND DRILLING EQUIPMENT
6210 NORTH CENTRAL EXPRESSWAY | DALLAS, TEXAS
OFFICES IN ALL PRINCIPAL OIL AREAS

"Now, for Pete's sake—don't make yourself ridiculous by saying something."

Three successful cementing jobs below 17,000 ft.



ON THIS DEEP CEMENTING JOB, with temperature and pressure both high, Unaflo* cement went into place without a hitch below 17,000 ft, in three successful operations in this Louisiana well.

Follow the example of oilmen who *know*—specify Unaflo Oil-Well Cement on *your* next well with critical temperatures and pressures. Unaflo slurries pump easily from the start, stay fluid under critical conditions, give you extra time when emergencies arise. Then, after the carefully calculated retarded period, Unaflo hardens to form a strong, durably bonded cement that is sulphate-resistant.

Unaflo complies with API STD 10A Specifications for oil-well cement, regular-type classes D and E. Write for typical data tables on Unaflo's down-the-well performance, and facts on our other cements.

UNIVERSAL ATLAS CEMENT COMPANY

UNITED STATES STEEL (US) CORPORATION SUBSIDIARY

100 PARK AVENUE, NEW YORK 17, N. Y.

*"UNAFLO" is the registered trade-mark of the retarded oil-well cement manufactured by Universal Atlas Cement Company.

PERFORMANCE-PROVED

U-145

Unaflo

RETARDED OIL-WELL CEMENT

CEMENTING DATA—Unaflo Case History No. 21 . . . Weeks Island Field, Louisiana

1. 7" OD casing run to 17,633' and cemented with 500 sacks of neat Unaflo cement. Static temperature 275°F., drilling mud weight 10 lbs. per gal.

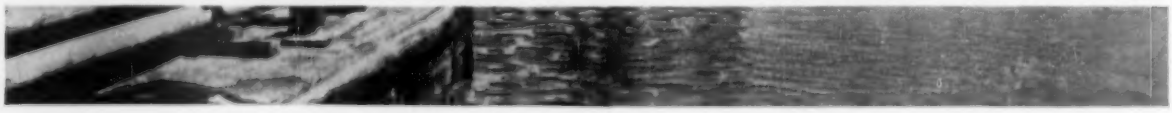
2. A squeeze job through perforations 17,530' to 17,554' using 150 sacks of neat Unaflo cement. 90 sacks in formation below tool with a maximum pump-truck pressure of 6,000 psi. 60 sacks reversed from the well.

3. A second squeeze job through perforations 17,450' to 17,464' using 150 sacks of neat Unaflo. 100 sacks out in formation below tool with maximum pump-truck pressure of 6,300 psi. 50 sacks reversed out of well.

ALL THREE JOBS WERE SUCCESSFUL AND WENT OFF WITHOUT A HITCH

OFFICES: *Albany · Birmingham · Boston · Chicago · Dayton · Kansas City · Milwaukee · Minneapolis · New York · Philadelphia · Pittsburgh · St. Louis · Waco*

United States Steel Hour—Televised on alternate Wednesdays—See your local newspaper for time and station.



West Texas Eyes Irion

by Frank J. Gardner

A COMPARATIVE newcomer to the oil-producing column now occupies center stage in West Texas exploration activity. It is Irion County, near the southern terminus of the Permian basin's eastern shelf. This has always been sheep and goat country, and although oil was found as early as 1928, major companies paid little attention to it until last year. Now, after the finding of at least 16 new fields within a year's time, drilling rigs dot the entire county, and an open lease is as rare as dog feathers.

It all began in May 1955 when Sinclair Oil & Gas Co. found Ketchum Mountain field; the first well made 129 bbl. a day from the Clear Fork at 4,414 ft. after plugging back from a final depth of 9,020 ft. in Ellenburger. Interest perked up then, and four more fields (Sugg, Peterson, Bingham, and Mertzon-San Angelo were found before year's end. Of these, the best was Sugg, with production of 334 bbl. daily from the discovery well, completed in Clear Fork at 4,535 ft.; this was a Sunray Mid-Continent Oil Co. find, and was the best strike in Irion County in many years.

A good chance . . . Since January 1 of this year, 12 discoveries have been racked up in the county, and as they continue to hit, operators have descended on Irion in droves. Not only are the success ratios much higher than usual, but the fields that have been found are yielding oil and gas from at least seven different formations. So far, production has come from the Ellenburger, Strawn, Canyon, Wichita (Wolfcamp), Spraberry, Leonard (Clear Fork), and San Angelo formations. So the chances of a hit are much better than average, and West Texans are taking advantage of the situation.

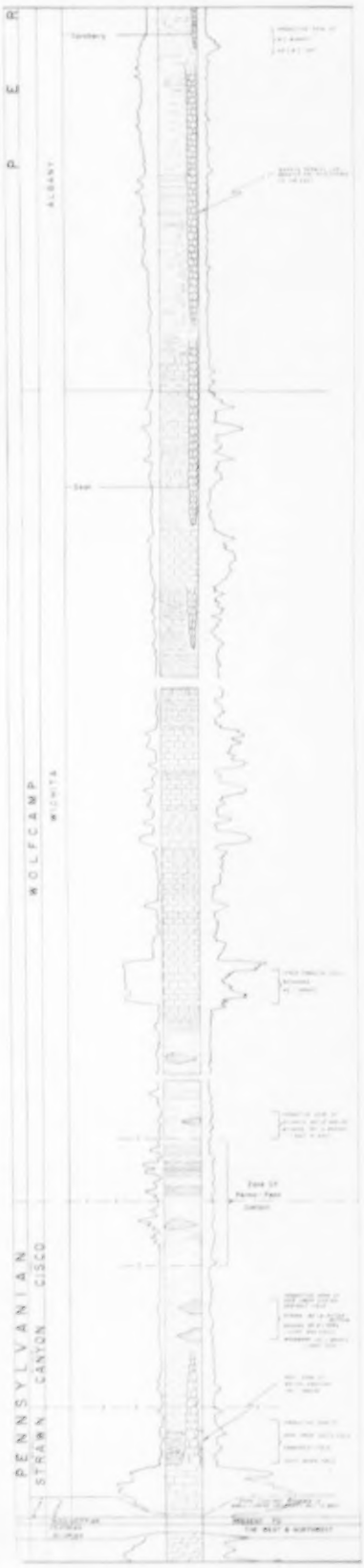
The San Angelo Geological Society has also seized upon it. As the nomenclature began to become cloudy on scout reports, and as more and more formations came into the producing column, this aggressive group compiled a standard type log to guide Irion oil hunters in the search. A portion of that log is reproduced on this page along with the map of developments to date. On this map, the fields shown in solid black have all been found since Sinclair's first discovery in May 1955. The open, or white fields are the older ones resulting from sporadic exploration between 1928 and 1955.

In a new county . . . Of the log, Bill Bivens, president of the San Angelo rockhounds, says: "This county leads our area in discoveries and the surface has barely been scratched. Since Irion is at our back door, we felt that our group should compile the log for the benefit of the many who have just heard of Irion for the first time."

The part of the log you see here is only a sample. The actual print includes every formation from pre-Cambrian up through the Quaternary. One thing that stands out on the log is the profusion of reef section that geologists have found in the Clear Fork, Albany, Canyon, and Strawn. It was British-American Oil Producing Co.'s reef strike at Sixty-Seven field that really set the county afire; that discovery, the 1 Noelke, made 206 bbl. a day from Strawn reef at 6,898-6,908 ft. last March.

Will produce new fields . . . So watch Irion. In another year's time, it can safely be assumed that the number of producing fields will swell, and as one formation after another is proved productive, the county will emerge as No. 1 oil target for West Texas hunters. Here's another story of neglect—28 years of it.

Irion County, West Texas, has had 12 new discoveries this year, with success scored all over the map (below); the type log (right) has been compiled by San Angelo geologists as an aid to further search.



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Economic factors are excellent but . . .

TABLE 1—COMPLETED WELL COSTS

	Williston Basin Common Well Depth Ranges—(ft.)				
Item of cost—	2,000 to 4,500	4,500 to 7,500	7,500 to 9,500	9,500 to 11,000	11,000 to 12,500
Drilling costs	$24,100	$47,450	$78,000	$171,000	$206,000
Completion costs	20,900	32,550	47,000	87,000	92,000
Dry-hole cost	26,500	48,450	95,000	178,000	224,000
Producing well cost	45,000	80,000	125,000	258,000	298,000

Williston Basin Exploration Needs Boost

by Kye Trout, Jr.

IN any geologic province which contains commercial oil and gas, the rate and degree at which the accumulations will be discovered and developed, within a given time, becomes the function of factors not entirely within the realm of related geologic and engineering sciences. Discovery and subsequent development of oil and gas fields in relatively new areas are controlled to a large degree by factors more subtle and intangible than the more exacting factors related to normal oil sciences.

Definition of factors which directly affect exploration efforts defies anything but generalities for broad use, but, their presence and influence can be recognized. A specific outline and analysis in terms of a given geologic province for a given time period can be made. The nebulous and intangible "something" to which allusion is made may be neatly packaged as "exploration economics."

Williston basin . . . After more than 5 years of exploration and development drilling in the Williston basin areas of North Dakota, Manitoba, South Dakota, Saskatchewan and Montana, there are certain factors, ideas, conditions, and results pertaining to exploration economics which can be dealt with to find what has been and, more important, what might be.

If we are not satisfied with the exploration situation in the Williston basin today, the first order of business is to find out why and then work for needed adjustments and changes.

If we think the economics of Williston basin exploration are sound and attractive, then it is quite obvious that an adequate job of informing the rest of the oil industry about the rare opportunities that exist has not been done, otherwise the exploration situation would certainly have been different during the past 2 years.

What the rest of the oil industry thinks of the Williston basin as a prospector's paradise is up to those who are in the basin and familiar with the facts of the situation. Information and data that has been provided may not have been complete. There may be more good than is realized.

And, there may be much that can be done to spur exploration, attract outside dollars for drilling, and start the high level of drilling that will be necessary to produce needed discoveries.

The total concept prevalent in the oil industry today regarding the Williston basin, the attitude, is not at all in keeping with the facts of the situation. Too many persons are still thinking of the basin in terms of the dark days of 1954 after the blush went off the boom.

The very first order of business is and must be to change the attitude of the oil industry in its thinking about the Williston basin. The total concept must indicate that the Williston basin is a good place in which to prospect and drill for oil and gas, a place where exploration dollars can be spent with reasonable expectations for profitable returns with a risk that is justifiable and prudent, and as normal as that in other oil provinces.

Basic premises . . . Exploration in a given area is controlled by several factors which are outlined and analyzed here. These factors may be considered together and totalled into a composite which is regarded as a competitive position. Thus it may be logically assumed that to have a rate and degree of exploration in the Williston basin pleasing to the greatest number of people, the environment pertaining to exploration must be competitive to the same situation in other active geologic provinces and drilling areas.

Further, the factors controlling exploration are in turn governed by certain conditions of geologic and economic significance—some of which are controlled by man—some of which are controlled by nature. Those controlled by nature, man can only determine, define, and deal with as he will as an individual. Those controlled by man present quite another matter. One can determine, one can define, one can deal—but one can also change. The challenge is for—Change!

For instance, one cannot change the geologic makeup and history of the Williston basin. God, in His infinite wisdom as manifest in nature, has created an indestructible pattern. But, man can change drilling costs; man can change success ratios; man can change marketing conditions; man can change the conditions of payout and investment; and in all these instances man, at one time or another, does bring about change as desired or needed.

The Williston basin, in its entirety, is not any different today than it was in 1951, when first oil and gas discoveries were made. In fact, infinitely more is known now. The most obvious change in the intervening period has been, not in the basin itself, but rather in the mind of man and his thinking about the Williston basin.

Factors affecting exploration economics . . . The several factors controlling exploration in a given area, which are considered here, are outlined as follows:

1. Cost of drilling for and producing oil and gas.
2. Success ratios.
3. Marketing conditions.
4. Quality and types of deals—both wildcat and drilling.
5. Conditions of payout and investment return.

The competitive position to which reference is made is largely the summation of these factors. The factors which have been set forth as being pertinent to exploration economics in the Williston basin today are examined here.

Author is petroleum engineer, geological consultant, Beach, N. D. Paper presented at the First International Williston Basin Geological Symposium sponsored by the North Dakota Geological Society and the Saskatchewan Geological Society, October 9-12, Bismarck, N. D.

TABLE 2—DRILLING AND PRODUCTION STATISTICS

Williston basin—Including the United States and Canadian portions

Time period	Wildcat wells	Discoveries	Producing wells	Dry holes	Total wells	Total production
Prior to 1951	56	0	0	56	56	0
1951	33	10	20	23	43	33,759
1952	175	28	199	174	373	2,413,222
1953	256	24	443	264	707	9,010,657
1954	392	12	503	411	914	14,730,899
1955	329	23	910	381	1291	27,125,759
1956*	121	8	392	137	529	22,807,644
(1956)†	(242)	(16)	(784)	(274)	(1058)	(45,615,288)
Totals	1365	105	2467	1446	3913	76,121,940

*Figures for the first 6 months of 1956. †Six months figures projected on 12-month basis.

Drilling costs in the basin for all depths, once thought to be prohibitive, are today considered very much in line with other areas of similar depths. Most drilling is routine, even in the greater depths, and there are few unusual drilling problems to increase costs. Drilling costs are a function of the time the drilling equipment is on location.

The time required to drill wells in the Williston basin is considerably less than would be normally expected. For instance, 25 to 30 days are required to drill and complete an 8,500-ft. producing well.

Cold-weather operations, once thought of as being a most disagreeable and noncompromising factor of cost, do not increase over-all costs to a point of burden. With properly equipped drilling equipment, wells and leases, drilling for and producing oil in the Williston basin becomes as usual as in other areas.

The facts of actual well costs for dry holes and producing wells shown in Table 1 show that drilling costs in the Williston basin are competitive with those of other areas of oil activity.

A cold appraisal of the facts and attitudes shows that industry long ago ceased to expect every wildcat to bring about a discovery as in the golden days of 1951 and 1952. Tables 2, 3, and 4 provide comparative statistics for wells in the Williston basin.

Over-all figures show the Williston basin to be no better and very little worse, than national averages for wildcat success ratios with a 1 in 12 chance after 5½ years.

On the other hand, considering total wells drilled as compared to producing wells completed, the Williston basin is considerably better off than most areas with a ratio of two producers completed for every three wells drilled.

Certainly, with a little more luck, and considerably more intelligent application of data relating to the problems of oil finding, the Williston basin can remain competitive, and more so, with other areas on the basis of wildcat successes.

In 5 years much progress has been made from the days of 1951 when discovered oil could not be readily sold and when sold it brought a substandard price after paying high transportation costs. Today, with pipelines and gravity schedule prices in most productive areas, little of the old condition remains.

Standard prices are paid for oils of the same gravities elsewhere. The top price paid for Williston basin crude is $2.90 per barrel. The over-all average crude-oil price amounts to $2.48 per barrel.

Presently, Williston basin crude markets are absorbing about 79,000 bbl. per day, which is less than the top efficient productive capacity. The promise for ever-increasing markets for basin crudes is bright. The long-range outlook is for increased markets commensurate with increased discoveries and production.

Most of the producing areas in the basin are now operating under statutory or voluntary systems of proration suited to available markets.

To the prospective Williston basin operator it can be said, "Don't stay out because of the lack of a place to sell oil you might find, come on in and drill—we can squeeze you in." This is a considerable improvement over the situation just 4 years ago.

Wildcatting . . . If the prospective operator heeds the invitation and decides to take a look at the available drilling and wildcat deals, he finds a weak spot in exploration economics and the competitive situation of the Williston basin. He quickly surmises that he will have to be very choosy and lucky to find a wildcat deal or a drilling deal in the Williston basin to match those that he can find elsewhere. And so, he cools to the issued invitation.

Wildcatting, and even total wells, in the Williston basin have been ever-decreasing from the higher levels of activity sustained in 1954. The trend prior to 1954 had been ever-increasing. There has been a reversal of form.

Crude demand during the same periods in the United States has constantly and steadily increased, as has total wildcatting and wells drilled in the United States and Canada. It can be assumed, perhaps, that the Williston basin has not been getting its share of the industry's exploration and development dollars.

But, with reasonable and competitive drilling and producing costs, fair success ratios, steady though limited markets, and competitive payout and investment returns, the reversal of form seems out of step with the times. Or, having once resulted, the reversal should be reversed.

An examination of some typical drilling and wildcat deals that have been consummated during the past 18 months provides enlightenment as to the competitive position of the Williston basin in this highly important area. Table 5 tabulates typical deals for the various common depth ranges.

Obviously, at this time, the Williston basin is clearly not competitive with other active oil areas on drilling and wildcat deals. Acreage and deals are plentiful, but takers are few. Dry-hole money and bottom-hole money available in the Williston basin is highly deficient.

And it is a paradox that this situation should exist with reasonable costs

TABLE 4—COMPARATIVE WELL STATISTICS

(Williston basin of the United States and Canada, 1951 to 1956)

	Canada	U. S.
Wildcats drilled	734	608
Discoveries	55	50
Producing wells	1511	946
Dry holes	761	685
Total wells drilled	2272	1631
Producing wells of total wells, per cent	66.5	59.0
Dry holes of total wells, per cent	33.5	41.0
Wildcats of total wells, per cent	32.3	37.2
Success ratio—wildcats	1 in 13	1 in 12
Success ratio—producing wells	2 in 3	3 in 5

TABLE 3—SUCCESS RATIOS BASED ON WILDCAT AND PRODUCING WELLS

Williston Basin

Time period	Wildcat wells	Wildcat discoveries	Producing wells	Total wells	——Success ratios—— Wildcats	Producing
1951	33	10	20	43	1 in 3	1 in 2
1952	175	28	199	273	1 in 6	1 in 2
1953	256	24	443	707	1 in 9	2 in 3
1954	392	12	503	914	1 in 30	1 in 2
1955	329	23	910	1291	1 in 14	5 in 7
1956*	121	8	392	529	1 in 15	3 in 4

*Figures for the first 6 months of 1956.

and prudent payout of the investment.

Investment return and payout of development are directly related to costs and markets. In the early days of Williston basin development the payout period was excessive and unrealistic because of the marketing situation. Now, however, the operator can prospect and produce oil in the basin with confidence that the over-all situation is conducive to sound economics.

Examination of actual Williston basin production figures, as shown in Table 6, for a typical month in 1956, indicates the present situation.

A normal, reasonable payout of well cost expected by most operators is in the range of 2 to 4 years. Anything better is happily accepted, and anything worse is not viewed with alarm if sufficient recoverable reserves are in place. The expected over-all investment return may vary with operators, but something of the order of 3 to 1 or 4 to 1 is generally acceptable and is considered worth going after.

Actual production figures for the Williston basin indicate a payout of 1 to 4 years may be expected for wells in the various ranges. The total investment return on a discounted basis, that is, present worth value, for the indicated recoverable oil in place is of the order of 4 to 1 or more. Certainly, payouts and investment returns, as indicated in Table 7, are attractive and competitive in the oil industry.

TABLE 6—PRESENT AVERAGE PRODUCTION OF PRODUCING WELLS
(Based on Average 1956 Month)
Williston Basin
Common Well Depth Ranges—(Feet)

	2,000 to 4,500	4,500 to 7,500	7,500 to 9,500	9,500 to 11,000	11,000 to 12,500
Producing wells	1129	100	797	7	
Monthly production	1,412,764	366,205	1,352,261	11,384	
Average production per well	1251	3662	1696	1696	
Projected annual production per well	15,012	43,944	20,352	21,512	
Daily average production per well	40	118	55	53	
(Daily allowable production per well based on North Dakota formula)	not prorated	not prorated	60	188	227

TABLE 7—AVERAGE PAYOUT AND INVESTMENT RETURN
Williston Basin Producing Wells
Common Well Depth Ranges—(Feet)

	2,000 to 4,500	4,500 to 7,500	7,500 to 9,500	9,500 to 11,000	11,000 to 12,500
Completed well cost	$45,000	$80,000	$125,000	$258,000	$298,000
Average annual production per well	15,012	43,944	20,352	21,512	
Average annual net income per well	$28,523	$98,874	$50,880	$53,780	
Payout of original well cost—years	1.58	0.81	2.46	4.80	
Estimated ultimate production per well	116,000	275,000	312,500	550,000	
Ultimate investment return discounted to present worth value	$176,000	$465,000	$585,000	$1,030,000	
Ratio of investment return to original well cost .08	3.9 to 1	5.8 to 1	4.7 to 1	4 to 1	

Summary

To summarize the thinking here presented in relation to the factors influencing and controlling exploration economics in the Williston basin today, the following conclusions are made:

1. The over-all situation in the Williston basin with respect to drilling and producing costs, success ratios, marketing, payout and investment return is reasonable and may be considered to be competitive with other oil areas.

2. Wildcat and drilling deals in the Williston basin are definitely deficient and generally unattractive to the industry, especially to that portion of the industry generally concerned with wildcatting and promotion. The most obvious deficiency is in the amount of dry-hole or bottom-hole money available.

3. The total concept of the industry concerning the Williston basin, its attitude, is not consistent with the facts of the situation. Too many persons apparently are still thinking of the basin in terms of the disappointments of 1954.

4. Even though present markets for basin crude are limited, constant expansion is being planned and put into effect. The promise is for reasonable marketing opportunities to provide for steady increases in crude production.

5. The wildcat success ratio has varied considerable from year to year but over-all is near normal for the industry. Nevertheless, the producing well ratio compared to total wells drilled is outstanding and offsets the wildcat ratio.

6. The Williston basin has not been receiving its share of the industry's exploration and development dollars in the past 2 years. This situation may be attributed to the somewhat elusive characteristic called attitude on the part of individuals and the industry.

Competitive position . . . The Williston basin today stands on the edge of an era. It is the end of one phase and the beginning of another.

Well-informed economists and executives within the oil industry have repeatedly stated in the past 12 to 15 months that the demand for crude oil is constantly rising and will continue to rise in the years ahead. The estimate is made that by 1965 the United States will be using 12,000,000 bbl. of crude per day. In just 9 short years, they say, our domestic oil industry must be producing 10,500,000 bbl. of oil per day. Others say that by 1975, the domestic industry in the United States and Canada must be producing 13,000,000 bbl. of crude per day to meet the demand.

In any event, it is quite apparent there will be no letup in the increasing demand for the products of the oil industry, and chances are the production per day will have to increase 50 to 60 per cent in a relatively short period of time.

This means, among other things, that operators must continue to interest themselves in new areas and geologic provinces, and even at an accelerated pace. Unexplored and undeveloped sedimentary units must receive more and more attention. The most important requisite for increased productive capacity and sustained high levels of production is adequate recoverable reserves to support this position. And the necessary new reserves for the industry of the next 10 years can only be found in the unexplored and undeveloped sedimentary units of the North American Continent.

Among the sedimentary units on the continent, the Williston basin is outstanding for size, geologic possibilities, availability, readiness for development, and potential productive capacity.

The initial acreage procurement of the current era was in 1949, 1950, and 1951. Therefore, the years 1959, 1960, and 1961 will be critical for the opera-

TABLE 5—TYPICAL DRILLING DEALS
Williston Basin, 1955-1956
Common Well Depth Ranges—(ft.)

	2,000 to 4,500	4,500 to 7,500	7,500 to 9,500	9,500 to 11,000	11,000 to 12,500
Total acreage	320	840	1200	1700	2600
Acreage contributed	160	520	20	960	1600
Percentage	50	61.8	60	56.5	61.5
Estimated dry-hole cost per foot	$7.80	$7.95	$11.30	$17.00	$18.65
Dry-hole money contributed per foot	$4.40	$3.28	$ 4.00	$ 4.70	$ 5.83
Percentage	56.5	41.2	35.4	27.6	31.2

tors holding acreage, and most interesting for exploration dollars looking for a place to be spent. The basin is in an excellent position for accelerated exploration and development because the necessary acreage has already been acquired and is available.

From the standpoint of the factors the operator considers most important —costs, markets, reserves, acreage, success ratios, payout, investment return, possibilities—the Williston basin today is ready, and it is competitive.

Conclusions

The Williston basin is a good place in which to prospect for oil, drill for oil, and produce oil. The time is ripe for the attitude of the industry to awaken to the opportunities that are present. It is time for the industry to spend a larger share of its exploration and development dollars here.

The most important factor to an outside operator looking in is the quality and type of wildcat and drilling deals that are available.

The general unattractiveness of deals in the past 2 years has hindered exploration and wildcat development. With additional money for dry-hole and bottom-hole purposes, the industry can take advantage of the competitive factors controlling the favorable exploration economics in the Williston basin today.

Wildcat drilling up to 1955 has been largely controlled by outside money looking for a place to be spent, especially in the years 1952, 1953, and 1954. In the years immediately ahead exploration and development will be controlled by the quality and types of wildcat and drilling deals.

Through presentation of factual data and intelligent analysis it is to be hoped that the total concept of the Williston basin locked in the industry mind may be enlightened to the point of arousing the industry to the advantages and opportunities present in exploration economics in the Williston basin today.

Acknowledgments

The author wishes to acknowledge the cooperation and assistance received from various operators in the Williston basin of the United States and Canada from whom data and information included herein was received. Specific acknowledgment is made to Currie Conrad of the Williston Basin Oil Review for assistance in securing several hard to obtain items of importance. The author expresses appreciation to the North Dakota and Saskatchewan Geological Societies for being invited to present this paper as part of the program of the First International Williston Basin Symposium and for permission to publish it.

EXPLORATION HIGHLIGHTS

ARK-LA-TEX

NORTH LOUISIANA

Just Rite Discovery Completed in Claiborne

Claiborne Parish, north-central Louisiana, has a new oil field as a result of successful completion of C. M. Roberson's stray Rodessa sand discovery. The well flowed 564 bbl. of 38°-gravity oil per day on 16/64-in. choke from open hole at 4,475-81 ft. The new field has been tagged Just Rite pool.

Lake Formosa Discovery Finaled in Tensas

The discovery well of Lake Formosa field was completed last week in Tensas Parish, east-central Louisiana. Jett Drilling Co., Inc., B-1 Fisher, SW SE 22-12n-10e, flowed 170 bbl. of 38.4°-gravity oil per day on 8/64-in. choke from the lower Tuscaloosa sand at 8,334-40 ft.

The discovery well is about ½ mile east of Lake Formosa and 1⅝ miles north of Justina.

Cotton Valley Field Extended in Webster

A. J. Hodges Industries, Inc., is testing at its 1 Greenard in 18-21n-10w, 1¾ miles northwest of Cotton Valley field production in Webster Parish. The well flowed 200 bbl. of oil per day on ¼-in. choke from perforations at 9,674-85 ft. in the Davis sand of the Cotton Valley formation. Gravity of the oil is 47°.

ARKANSAS

Biggest Gas Well Completed by Carter

Carter Oil Co. has completed the largest natural gas well ever drilled in North Arkansas. Carter Oil Co. 1 L. B. Caroister was completed October 22. The estimated open flow is 78,540,000 cu. ft. of gas a day. The huge new well is in Moreland field 10 miles north of Russellville, Ark.

Drilling on this new well started July 15. The production level is at 5,208 ft. Final tests were completed last week.

With a daily production of 70,000,000 cu. ft. of gas, the previous record gas producer was in Cecil field near Fort Smith.

MID-CONTINENT

OKLAHOMA

Ordovician Discovery South of Criner

Goff-Leeper Drilling Co. and Gene Goff 1 Little, NW SE 4-5n-3w, south of Criner in McClain County, south-central Oklahoma, looks like a big Ordovician strike. The well has pay in the Hunton, 32 ft., 115 ft. in first Bromide, and 10 ft. in the Tulip Creek or second Bromide sands.

The well flowed 300 bbl. of oil in 10½ hours on 24/64-in. choke from perforations at 9,792-9,800 ft. in the lower Ordovician sands.

The well flowed 262 bbl. of oil in 10½ hours through 24/64-in. choke from Hunton lime perforations at 8,670-86 ft. The first Bromide sand is the best pay. Testing is still under way in this zone through perforations at 9,610-22 ft.

HUGOTON EMBAYMENT

NORTHWEST OKLAHOMA

New Morrow Gas Discovery Hinted

An indicated Morrow gas discovery in Harper County, the Keating Drilling Co. 1 Dunn, NW NW SE 22-28n-26w, flowed 2,830 M.c.f. of gas per day on drill-stem test at 6,360-6,400 ft. Recovery was 240 ft. of gas-cut mud.

Keating has staked an offset try at NW NW SE 23-28n-26w.

SOUTHWEST KANSAS

Two-Zone Discovery Indicated for Seward County

Southwestern Exploration Co. and Vickers Petroleum Co., Inc., are testing at a wildcat discovery, their 1 Collins, in east-central Seward County.

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The two-zone discovery falls in Section 16-32s-31w. Operator ran a drill-stem test of the interval 5,560-5,654 ft. in the Morrow sand. The well immediately started to flow gas at the rate of 1,190,000 cu. ft. per day with some condensate.

Marmaton oil production was indicated on a drill-stem test of the zone between 5,045-75 ft. Gas reached the surface in 26 minutes; operator recovered 90 ft. of oil and gas-cut mud and 270 ft. of gassy high-gravity oil with no water.

The new discovery is a rank wildcat and is 6 miles from the nearest production. The Northwest Kismet field, 6 miles south of the Vickers-Southwestern Exploration 1 Collins, produces gas from the Morrow sand. The Stevens field produces gas from the Marmaton.

APPALACHIAN

OHIO

A wildcat 5 miles west of the city of Coshocton was brought in as a gasser by the Arrowhead Exploration Co. On 1 Sandy Miller, Section 8, Jackson Township, Coshocton County, Clinton was logged at 3,555-76 ft. and gaged 1,200,000 cu. ft. after fracture.

- Natol moved ¼ mile south of old production in Killbuck Township, Holmes County, and found a fair showing in the 7 Murl Bell, Section 20. Clinton sand at 3,125-85 ft. gaged 500,000 cu. ft. gas and 50 bbl. oil in a 24-hour test after fracture.
- In Spring Mountain pool, Preston Oil 2 Carpenter-Conkle, Section 13, Monroe Township, Coshocton County, gaged 80 bbl. in 24 hours after fracture.
- Devonian Gas & Oil Co. et al completed the fifth successful oil well in Hopewell Township, Muskingum County. The fourth well, 1 Scott Rankin, and fifth, 2 Scott Rankin which were completed recently were among the largest in the field. The 1 Scott Rankin, after fracturing with 400 bbl. of lease crude, flowed 1,300 bbl. of oil in the first 24 hours, 400 bbl. of this production, of course, had been injected into the formation during the fracturing process. The 2 Scott Rankin well was completed October 17 flowing at about the same rate as the No. 1 well. The No. 2 Rankin had a larger amount of gas, about 1,500 M.c.f. Both of the foregoing wells are being produced at a controlled rate of 100 bbl. of oil each per day.

Morrow Oil & Gas Co., a subsidiary of Devonian, is drilling an offset well to the Elsie Carson, Section 15, Hopewell Township, and was at a depth of 2,560 ft. as of October 17.

PENNSYLVANIA

In Armstrong Township, Indiana County, Southwest Pennsylvania, Columbian Carbon Co. No. 1-1833 Susie Yosurack, wildcat completed with 4,500,000 cu. ft., gas after fracture, Onondago 7,618 ft., chert 7,632 ft., Oriskany sand 7,757-88 ft. TD 7,802 ft.

- Since the recent completion of the Stewart & R. & P. Coal Co., well No. 4336 in Young Township, by Manufacturers Light & Heat Co., which gaged over 10,000,000 cu. ft., gas in the Oriskany sand, six new wells have been started, five by major operators and one by an independent. A considerable amount of money will be spent in this development and the results will be awaited with great interest.

WEST VIRGINIA

Dry Fork district, Randolph County, West Virginia, Columbian Carbon Co. 1238 U.S.A., elevation reached the chert at 5,045 ft., ran the 7-in. casing and is drilling at 5,054 ft. Nelson W. Taylor, Agent, is running tubing at 6,276 ft., to fracture No. 1 H. R. Tingler in Oriskany sand.

EASTERN KENTUCKY

On Waller Branch in the Pike County sector of Big Sandy gas field, United Carbon Co. have completed a good well at 1 John S. Cline, Jr. Mississippian Big Lime, topped at 2,094 ft. and penetrated to 2,333 ft. total depth yielded gas naturally at the rate of 3,991,000 cu. ft. daily. Test responded to acid very well increasing flow to 8,000,000 cu. ft. daily after 3,000 gal. Rock pressure in 48 hours registered 602 psi.

GREAT LAKES

MICHIGAN

New Traverse oil well completion on the extreme west-northwest edge of Huber Traverse field, Newaygo County, may prove the key to more active development of this field which was discovered late in 1955.

This producer, Klondike Petroleum Co., Inc. 1 Johnson, NE NE SW 5-14n-14w, Denver Township, flowed natural at an estimated rate of 40 to 50 bbl. of oil an hour before production was restricted to 75 bbl. a day, the per well allowable flow-rate established by a proration order for the pool.

The 1 Johnson appears to be the best oil well drilled to date in the pool. Well is the second highest producer in the field on the Traverse and is only 10 ft. lower than the 1 Hoge, the discovery well which has been rated pool's best well until this completion. New well is the diagonal southwest offset to a recent completion by The Carter Oil Co. and is the west 1,320-ft. offset to an earlier completion by Klondike.

Its apparent rise in structural position in correlation with offset wells, and its strong potential flow rate appears to indicate a possible westward extension of the pool. Traverse lime at 1 Johnson was logged at 2,122 ft. Tools were racked after pay was penetrated 3 ft. to 2,125 ft. Well filled and flowed within seconds after gas first showed to the surface.

PACIFIC COAST

CALIFORNIA

Texaco Extends Gas Field Production

The Texas Co. successfully extended production in the Rio Vista-Georgiana Slough gas field more than ½-mile northwest. The Sacramento County wildcat, 3 Arthur Brown, was completed in the interval 3,240-3,300 ft. flowing 2,000 M.c.f. daily. Total depth of the test, located in SE SE 3-4n-4e, is 3,440 ft.

Oceanic, Superior Sign Huge Deal

Oceanic Oil Co. and Superior Oil Co. and W. M. Keck, Jr., completed a major farmout deal whereby Superior and Keck will take over exploration operations on Oceanic's 15,500 acres in Kern and San Luis Obispos counties. Under terms of the pact, Superior and Keck will drill two 12,500 ft. Eocene tests and a 14,500 ft. Eocene test. On this part of the deal, Oceanic will retain a net profit overide from 15 to 43 per cent. Keck and Superior will drill five other tests ranging from 3,500 to 9,500 ft. on which Oceanic will keep a 37½ per cent net profit override.

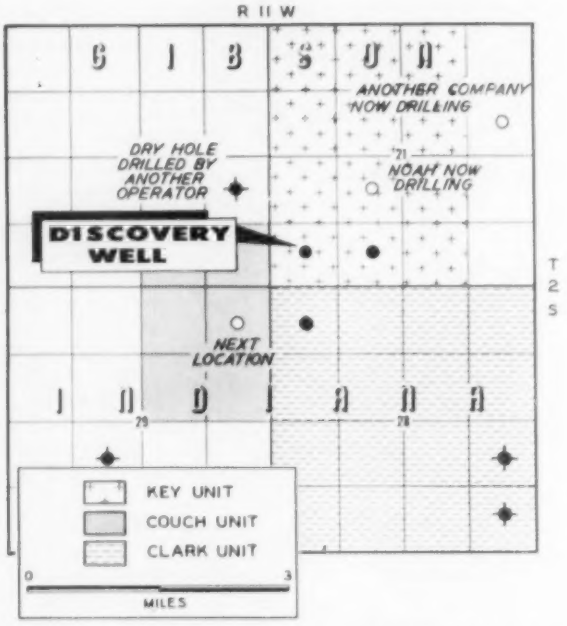
WESTERN CANADA

SASKATCHEWAN

Remote Wildcat Slated In North Central Area

Hudson's Bay Oil & Gas Co., Ltd., will drill a wildcat 90 miles north of the city of Prince Albert in north-central Saskatchewan. The new test will be known as the 1 Montreal Lake, LSD 8, 15-64-24w2, at the north end of the lake. The nearest previous drilling was on the other side of the lake, 30 miles south, at Fina 1 Montreal, a dry hole.

PARTNERS Stuart G. Noah and Fred A. Noah are shown here with Lee D. Murray, drilling superintendent, (right) at one of their Gibson County wells.



LOCATION of Noah Petroleum Co.'s successful Benoist operations in Gibson County, southwestern Indiana, 3 miles southwest of Princeton is shown on this map.

40-Year-Old Indiana Field Regains Youth

. . . New wells average 200 bbl. per day in Gibson County

AN "off-and-on-again" 40-year-old producing area 3 miles southwest of Princeton, Ind., is being drilled once more with success.

Noah Petroleum Co.'s 1 Key unit in 21-2s-11w, Gibson County, southwestern Indiana, was completed in September flowing 102 bbl. of oil per day on ½-in. choke from the Benoist (Bethel) sand.

Noah has added two more wells in the area, each flowing about 100 bbl. per day. The wells all produce from the Benoist at a depth of 2,150 ft. The company's engineers hope for 15 locations with a possible recovery of 100,000 bbl. per 10-acre location.

Drilling procedure . . . Noah drilled the wells with company rotary tools in about 5 days total. The wells swabbed very little oil naturally. The 1 Key-Gooch unit swabbed about 1¼ bbl. per hour, No. 2 well about ¾ bbl. per hour, and the 1 Clark about 25 gal. per hour. They were cleaned out by swab and bailer and then hydrafraced with a four-batch job—3,200 gal. of kerosine—6,400 lb. of sand.

They were shut in for 24 hours, then opened for flow test. No. 1 Key-Gooch unit flowed 45 bbl. of oil the first hour and then was choked to ¼-in. Initial potential was 304 bbl. per day. All the wells in the new area still are flowing under ¼-in. choke, approximately 200 bbl. of clean oil per 24 hours.

Noah drilled an 8¾-in. hole, set 5½-in. 14-lb. seamless casing through the pay and perforated with bullets. The three wells have made 17,000 bbl. plus since discovery and Noah is moving in for two additional wells.

Successful Wildcats

MICHIGAN

Allegan County: Oil Producers, Inc. 1 Schafer, NW NE SW 18-3n-12w. Pump 6 BOD from Salina dolomite pays after 2,000 gal. acid. TD 3,140 ft., PBTD 2,885 ft. (New, deeper pay in West Hopkins pool.)

SASKATCHEWAN

Gridoil 16-7 Viewfield, LSD 16, 7-7-8w2. TD 4,480 ft. Mission Canyon oil well.

ALBERTA

Hudson's Bay 1 Eagle Hill, LSD 7, 30-33-4w5. TD 9,294 ft. Mississippian oil well.

MONTANA

Prairie County: Shell Oil Co. 41-31 "C" Unit, NE NE 31-14n-51e. IPP 78 BO, 3 BWPD, Red River discovery, new field. TD 9,202 ft. Red River.

WYOMING

Natrona County: Sinclair Oil & Gas Co. 8 Government, SE NW SW 10-40n-78w. Swabbed and flowed 1,944 bbl. of oil per day, 31.1° gravity, Tensleep discovery, new pay. TD 7,835 ft. Tensleep.

COLORADO

Logan County: British-American Oil Producing Co. 2 "B" Reiners, N½ SE SW 22-11n-53w. IPF 292 BOPD, 30/64-in. choke, 2,170 M.c.f. of gas per day, "J" sand discovery, new field. TD 5,390 ft. "J" sand.

Shawnee Oil Co. et al 1 Mittelstadt, C NW SW 29-10n-53w. IPF 840 BOPD, "D" sand discovery, new field. TD 5,002 ft. Skull Creek.

Mesa County: Gordon Hurd 1 Government, SW SW NW 36-8s-91w. IP 4,260 M.c.f. of gas per day, Mesaverde discovery, new field. TD 4,180 ft. Morrison.

(Continued on page 184)

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Jac LeGoff asks:

"WOULD YOU WANT YOUR SONS TO ENTER THE SAME BUSINESS YOU'RE IN?"

JACOB A. CITRIN of the Citrin Oil Co., Detroit, Michigan: "In my case—yes, And I'll tell you why. Our company, of which my father and I were the founders, is a wholesale distributor of oil. Our future—and that means the future of my sons—depends largely on two things—the quality of the products we distribute and the policy of our large oil company supplier toward our own smaller oil company. Standard Oil, our major supplier, is noted for fine products. The company's policy toward us in the thirty-five years we have been associated has demonstrated Standard Oil Company's belief in the future of the independent oil jobber. Our relationship is an example of the fine teamwork possible between big and small companies under the American business system. We are now a corporation and one son is already an officer. The interests of the other two sons are being held in trust until they finish their education."

Left to right: Robert M. Citrin, Barney Citrin (co-founder), Jacob A. Citrin (co-founder), Martin E. Citrin, Toby Citrin.

WALLACE A. COWAN, Standard Oil Dealer, Council Bluffs, Iowa: "You bet I do! I have a boy, 16, and he's already helping me after school and on weekends. He wants to start in here full time just as soon as he finishes school, because he likes a service business, a business where he can meet people and be his own boss. There are not many businesses that offer the same opportunity for serving your friends and neighbors."

PAUL PETSCHKE, Standard Oil Agent, Downers Grove, Illinois: "Well, if I had my own life to lead over again, I'd want to do the same thing I'm doing right now. My son is already in my business. He, too, enjoys the friendships that you make in a job like this and also likes having the same opportunities for service. Another thing—people have confidence in my products—and that's pretty hard to beat in business."

JACK CLARK, Standard Oil Dealer, Des Moines, Iowa: "I've been a Standard Oil dealer 22 years. I have been active in church work and civic activities and am a member of the Chamber of Commerce. It is a satisfying life's work to serve people, both in business and out. I would be most happy if my sons, Bill and David, should enter the service station business."

Left to right: Mr. and Mrs. Clark, Bill, David.

What Makes A Business A Good Citizen?

We are proud of our long and successful association with such fine people. In the case of the Citrins, for example, the new officer represents the third generation in the same business. Many Standard dealers, distributors and employees have been with our company for years and many want their sons, too, to continue business relations with us in the oil industry. We regard that as a fine compliment. And we feel that the policies of fair play that helped to create such loyalty contribute to the many benefits received by the public under our free and competitive business system.

STANDARD OIL COMPANY (INDIANA) STANDARD

Williston Basin Symposium . . .

ABSTRACTS

Members of the North Dakota Geological Society and the Saskatchewan Geological Society played hosts for the First International Williston Basin Symposium held at Bismarck, October 9-12. Here are abstracts from a few of the papers presented at this symposium.

Exploration Ecnomics in the Williston Basin Today

KYE TROUT, JR., petroleum engineer, geologist, Beach N. D.

AFTER 5 years of exploration and drilling, the Williston basin stands today in a competitive position with other active oil and gas exploratory provinces. Drilling costs in the Williston basin are comparable with other areas of similar depths and are not excessive. Cold weather operations add to the over-all cost but do not hinder or stop exploratory drilling. There are few outstanding drilling problems and drilling can be accomplished in minimum time.

Presently, the typical Williston basin drilling deal is not competitive with exploratory or wildcat deals in other areas. More dry-hole and/or bottom-hole monies will be needed to achieve an exploratory level that will result in a drilling pace required to bring about needed evaluation and discoveries, and to attract the outside wildcat dollars. The acreage situation is presently good.

Marketing of oil in the Williston basin is vastly improved over 1952, and it appears that the market for Williston basin oil will expand in line with increased discoveries and production. Over-all payout of completed wells capable of making the prorated allowable will approximate 40 to 60 months, depending upon the depths involved.

In terms of oil and gas reserves, the Williston basin will afford the prospector an adequate investment return on the monies spent for drilling and completion of wells. Presently, estimates based on limited histories of the fields now producing indicate an over-all return on investment from 3 for 1 to as high as 8 for 1.

An objective analysis leads to the conclusion that the Williston basin is the most likely large, relatively undeveloped sedimentary unit on the North American Continent in which to look for oil and gas in the years immediately ahead.

Bowes field, Blaine County, Montana

R. E. HUNT, The Texas Co., Lewistown, Mont.

BOWES field, the only oil-producing area of north-central Montana, was discovered by Northern Ordnance in 1949. Production is from the Piper formation of Jurassic age, at a depth of 3,400 ft.

The Piper formation at Bowes is 213 ft. thick and divided into Bowes, Firemoon, and Tampico members, in descending order. The productive Bowes and Firemoon members consist of calcareous sandstone, and oolitic or sandy limestone. The producing interval has relatively low primary porosity and permeability, but acidization is an effective means of increasing recovery. Vertical and horizontal fracturing has been noted in a few cores, but drill-stem tests suggest that fractures do not contribute significantly to production.

The Bowes structure is a simple dome with more than 200 ft. of closure. The configuration of the feature, as well as its proximity to the Little Rocky Mountain, Twin Butte, and Wild Horse Butte intrusives, suggest it is underlain by a deep-seated laccolith. The surface expression of the structure is masked by a complex normal fault system that disrupts only the Upper Cretaceous section.

There are 74 producing wells in Bowes field. The recovery mechanism is thought to be solution gas drive, perhaps aided slightly by water encroachment.

Bowes field and other areas of Jurassic production in southwestern Saskatchewan demonstrate why this extreme western part of the Williston basin is the site of an active exploration and drilling program on the part of many companies. The certainty of additional production, as attested by excellent Piper shows in a high percentage of wildcats in north-central Montana, plus shallow and inexpensive drilling guarantee continued interest in this area.

Use of the Seismic Method in the Williston Basin

J. D. PERRYMAN, Geotechnical Corp., Dallas, Tex.

NOT the least of the factors discouraging some operators from the Williston basin are the over-emphasized seismic problems. Because a variety of geologic conditions are present, practically all seismic techniques have a place.

Most of the disappointments can be traced to the failure to state the geologic conditions expected in parameters suited to the method, and the failure of the seismologist to recognize limitations fixed by the field practices.

The generally excellent-appearing recordings may result in toleration of shipshod field techniques and insufficient attention to the less obvious reflections. The data on the maps of many supposed failures faithfully record the relief and such data can be made useful by the historical approach and pictorial contouring. Isopachs are especially useful not only for stratigraphic trap studies, but also for dating movements, evaluating computations, etc.

Isopachs of closely spaced reflectors are highly significant and deserve rigorous treatment. The seismograph does furnish data on many geologic conditions, often dismissed as not suited. Such data can be made useful by diligent, intelligent collaboration of the seismologist and geologist.

The Alida Field, Southeast Saskatchewan

P. R. VOGT, Imperial Oil, Ltd., Regina, Sask.

AT Alida oil occurs in an erosional feature at the subcrop of the porous Mississippian Mission Canyon formation. Closure on the updip edge of the Alida feature is provided by the unconformable overlap of the Jurassic Red Beds across the truncated edge of the productive reservoir. Lateral closure is provided by the Red Bed infilled erosional lows along the flanks, and downdip a water line controls the field limit.

The reservoir is a poorly sorted micro to medium grained fragmental and locally oolitic limestone, with good interfragmental porosity. The pool has a gas cap, clean oil zone, and an abnormally thick interval of transition from oil to water. The gas-oil contact appears to be horizontal while the oil-transition and transition-water contacts dip in a southwesterly direction.

Exploratory drilling subsequent to Alida has resulted in the discovery of similar type fields and proved reserves in this prospective subcrop trend are fast approaching 100,000,000 bbl.

Types of Oil Fields in Bottineau County

M. H. SMITH, geologist, Northwest Geological Service, Bismarck, N. D.

BOTTINEAU County is located in North Central North Dakota. North Westhope field and Northeast Landa field are presented as examples of the two known types of oil fields in this county.

North Westhope field is located in a structural syncline plunging to the southwest. Production is from a porous limestone zone in the Mississippian Charles formation. Due to the pre-Triassic erosion, this zone disappears updip where it is overlain at the wedge edge by Triassic Red Beds. Thus the accumulation in the field is caused by a stratigraphic trap in the structural syncline.

Northeast Landa field is located on an east-west trending anticlinal structure with approximately 100 ft. of closure. Production is from a porous limestone zone in the Mississippian Mission Canyon formation.

(Presented with cooperation and permission of Northwest Geological Service.)

Producing Areas on the Northern Portion of the Cedar Creek Anticline, Dawson County, Montana

W. E. DAVIS and **R. E. HUNT,** The Texas Co., Lewistown, Mont.

FIVE years of production have been established on the north portion of the Cedar Creek anticline: Yellowstone, Glendive, Deer Creek, Sand Springs, and Woodrow fields. Charles-Mission Canyon (Miss.), Interlake (Sil.) and Red River (Ord.) intervals have proved productive in the area.

Closures on this portion of Cedar Creek anticline lack the magnitude and areal extent of the producing areas to the south, i.e. Pine, Cabin Creek, Pennel fields. The multipay characteristics of these southern fields

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are not evident to the north at the present stage of development. Producing structures on the northern portion of the anticline are not complicated by faulting other than the main Cedar Creek reverse fault, which apparently was first active in post-Devonian-pre-Mississippian time. Truncation of pre-Mississippian rocks on the crest of the anticline following this faulting and later stratigraphic variation, due to either regional uplift or renewed movement along the main fault, offer interesting problems related to the search for future reservoirs.

East Poplar Field, Roosevelt County, Montana

JOE VERCELLINO, geologist, Carter Oil Co., Wolf Point, Mont., and **EMERSON K. BEEKLY,** Murphy Corp., Wolf Point, Mont.

EAST POPLAR field is a combination anticlinal-stratigraphic trap producing from Mississippian rocks. Maximum closure found on the principal Charles producing zone is 135 ft. with an oil column of 235 ft. The field has an inclined oil-water interface sloping toward the north.

All commercial quantities of oil produced to date are restricted to four porosity zones in the Charles formation, with an average producing depth of 5,800 ft.

Discovered in March 1952, the field is in its fourth year of development. Current daily oil production varies from 5,000 to 12,500 bbl. of oil daily, depending on market outlet. Productive area is approximately 18,000 acres with an accumulated production of 10 million barrels of oil.

Virden-Roselea and North Virden Fields, Manitoba

C. A. BERG, California Standard Co., Virden, Man.

THE Virden-Roselea and North Virden fields are located on the northeast flank of the Williston basin. They were discovered in 1953 and development is still in progress.

The reservoir rocks are largely stable shelf, clastic limestone members of the Mississippian Lodgepole formation. A combination of:

1. Local structural warping.
2. Permeability barriers, from secondary effects, have formed the trap.

These secondary processes in order of occurance are:

1. Leaching of limestone at the post-Mississippian unconformity.
2. Dolomitization of the leached limestone during initial evaporite deposition of Amaranth (Middle Jurassic) age, resulting in a major decrease in permeability and a minor decrease in porosity.
3. Anhydrite infilling during later Amaranth deposition resulting in reduced porosity and locally in reduced permeability.
4. Leaching of exposed limestone members during the post-Middle Jurassic-pre-Upper Jurassic disconformity resulting in increased permeability and porosity in the North Virden field.

Fracturing has accompanied the strutural movements. Pre-Amaranth fracturing has been infilled with anhydrite post-Amaranth fracturing remains open and is an important reservoir feature.

Within any separate accumulation each individual permeable zone in the reservoir has its oil-water interface which, once updip from edge water, becomes the base of permeable zone and thus follows the structure.

It is probable that the main source of the oil is from the downdip shale and argillaceous limestone facies of the clastic limestone reservoir rock.

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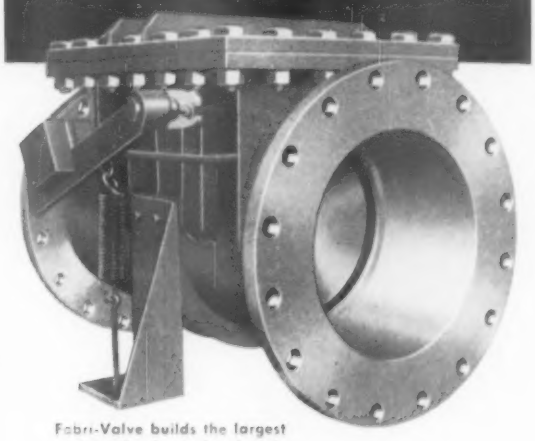

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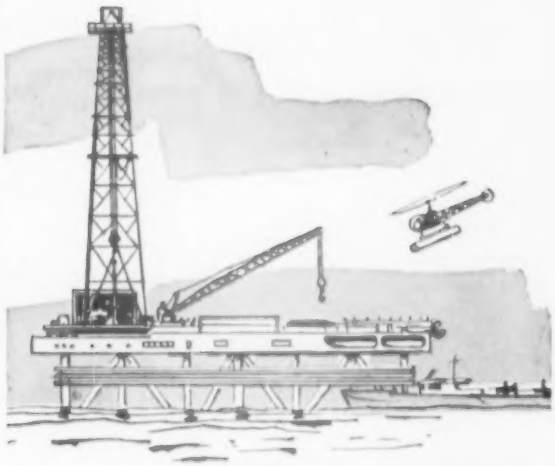

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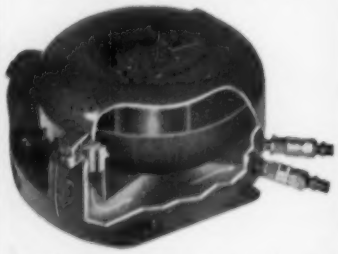

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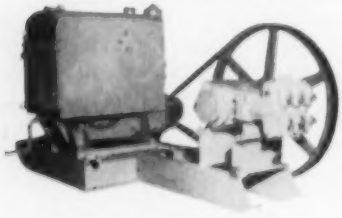

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(Continued from page 178)

WEST CENTRAL TEXAS

Taylor County: Alvin C. Hope 1 Frederickson, Subd. 17, Guadalupe CSL, 7½ miles SE Merkel. IP 55 BOPD, 14/64-in., 39°, TP 240 psi., GOR 960, Capps lime 4,460-70 ft. TD 5,313 ft.

SOUTHEAST NEW MEXICO

Lea County: Humble Oil & Refining Co. 2 South Four Lakes Unit, 2-12s-34e. New pay in new pool. IP 560 BOPD, ¼-in., 56°, top Devonian 12,343 ft., perforated 12,809-59 ft. TD 12,924 ft., elev. 4,156 ft.

Sinclair Oil & Gas Co. 1 Seaman Unit, 13-16s-33e. IP 612 BOPD, 40/48-in., 42.7°, GOR 1979, Pennsylvanian perfs. 11,219-65 ft. TD 14,797 ft., PB 12,758 ft. Elev. 4,169 ft.

Sunray Mid-Continent Oil Co. 1-E Federal, 28-18s-33e. IP 60 BOPD, 12/64-in., TP 980 psi., GOR 1960, 30°, Penrose sand 4,379-4,492 ft. TD 4,499 ft. Elev. 3,791 ft.

MISSISSIPPI

Jefferson County: Jett Drilling Co. and Robert Oil Co. 1 Lisbony Unit, 26-9n-2w. IP 99 BOPD, ¼-in., 41.5°, perfs. 5,435½-37½ (Wilcox-Artman sand). TD 6,021 ft. Elev. 219 ft., Wilcox 3,763 ft. (New field—Reeves.)

LOUISIANA GULF COAST

St. Mary Parish: Pure Oil Co. 1-F State Lease 833, Blk. 32, Eugene Island area, Gulf of Mexico. IP 12,740 M.c.f. daily ⅞-in., 20 BC per M.M.c.f., perfs. 12,478-12,526 ft. and 12,536-51 ft. TD 16,868 ft. (New pay in Eugene Island Block 32 field.)

TEXAS GULF COAST

Chambers County: Sun Oil Co. 2 State, Tract 132, Galveston Bay. IP 186 BOPD, XX-32 choke, 37.7°, GOR 1,463 cu. ft. per barrel, perfs. 8,624-30 ft., and (dual completion) 1,400 M.c.f. daily, open-flow potential, perfs. 8,530-40 ft. TD 9,471 ft. (New field, or 1½ miles west extension of Red Fish Reef field.)

Union Producing Co. 2 Wilcox, T. J. Chambers Sur., A-9. Shut-in gas well, no gage, dry, perf. 8,500-ft. sand. TD 8,580 ft. (New field.)

Galveston County: John W. Mecom 13-B Maco Stewart, W. K. Wilson Sur., A-208. Shut-in gas well, no gage, perf. 15,000-ft. sand. TD 17,444 ft. (New pay and extension in Gillock area.)

Kleberg County: Arkansas Fuel Oil Corp. 1 May et al., Kocks First Subd., Riviera Lands, Sec. 7. IP 187.24 BOPD, P-32 choke, 39.8°, GOR 795 cu. ft. per barrel, perfs. 8,245-50 ft. TD 9,572 ft. (New pay in May field.)

Montgomery County: Delhi-Taylor Oil Corp. 1 Sealy-Smith Foundation, James Hodge Sur., A-19. IP 1,560 M.c.f. daily, ½-in., GOR 43 M.c.f. per barrel, 43.7°, perfs. 11,540-90 ft. (Wilcox). TD 11,969 ft. (New field in Grand Lake area—1½ miles east of Lake Creek field.)

Nueces County: Morgan Minerals Corp. 3 Gallagher, J. H. Smith Sur., A-305. IP 148.19 BOPD, 5/32-in., 49°, perfs. 7,340-44 ft., and (dual completion) 165.24 BOPD, 9/64-in., 41.6°, perfs. 7,187-91 ft. TD 8,916 ft. (New pays in Baldwin field.)

SOUTHWEST TEXAS

Duval County: Standard Oil Co. of Texas 13 Jack Casey, San Pedro de Charco Redondo Sur., A-475. IP 1,500 M.c.f. daily, ¼-in., perfs. 5,784-94 ft. TD 7,625 ft. (New pay in Sejita field.)

Sid Katz 1-H W. R. Peters estate, GB& CNG Sur. 33, A-724. IP 205.81 BOPD, ¼-in., 38.8°, perfs. 5,693-5,708 ft. (Queen City). TD 6,350 ft. (New pay in Peters field.)

San Patricio Oil Corp. et al., and Pratt-Hewitt Oil Corp. 1 Black, J. Poitevent Sur. 129, A-376. IP 11,000 M.c.f. daily, open-flow potential, GOR 130 M.c.f. per barrel, 64.1°, perfs. 4,603-13 ft. (Pettus). TD 4,670 ft. (New reservoir in La Jara area.)

Hidalgo County: Bettis & Shepherd 1 Crutchfield, Sec. 294, Porcion 69, J. C. Kelly Subd. (3 miles S of Pharr). IP 7,000 M.c.f. daily, open-flow potential, GOR 73.94 M.c.f. per barrel, 59°, perfs. 7,019-26 ft. TD 8,490 ft. (New field.)

Jim Wells County: Keemac Lease Service and Flourney Drilling Co. 1 Price, I&GN Sur. 24, A-237. IP 6,000 M.c.f. daily, open-flow potential, dry gas, perfs. 1,878-83 ft. TD 2,440 ft. (New field.)

McMullen County: Peet Oil Co. 3 Ezzell, Sec. 53, Hays-Ezzell Ranch Subd. IP 4,000 M.c.f. daily, open-flow potential, perfs. 4,984-94 ft. TD 6,485 ft. (New field.)

Starr County: Sun Oil Co. 21-A Garcia Land & Livestock, Porcion 97. IP 56.57 BOPD, 3/32-in., 45.7°, GOR 475 cu. ft. per barrel, perfs. 4,932-34 ft. (Vicksburg). TD 8,200 ft. (New pay in Braulia field.)

Sun Oil Co. 2-D Speer-State, George W. Speer Sur. 274. IP 11,300 M.c.f. daily, open-flow potential, GOR 60 M.c.f. per barrel, 50.2°, perfs. 9,022-46 ft., 9,065-82 ft., and 9,086-9,110 ft. TD 10,103 ft. (New field—Lyda.)

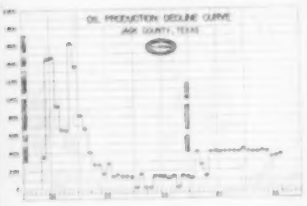
Webb County: Weaver & Sharp 1 Biel, Sur. 2403. IPP 16.9 BOPD, 22.3°, open hole 1,001-04 ft. TD 1,004 ft. (New field—Biel.)

SECONDARY RECOVERY
CABLE ENGINEERING
TECHNICAL CONSULTING PRODUCTION ENGINEERING SERVICE, INCLUDING CORE ANALYSIS

PRESSURE MAINTENANCE WITH GAS OR WATER

OIL PRODUCTION GRAPH

Pressure Maintenance with Water Injection



Strawn Sand
Jack County, Texas

REPRESSURING WITH GAS OR WATER

SURVEYS
ESTIMATES
DESIGN
INSTALLATION
SUPERVISION

PETROLEUM ENGINEERS
CABLE ENGINEERING
WICHITA FALLS, TEXAS

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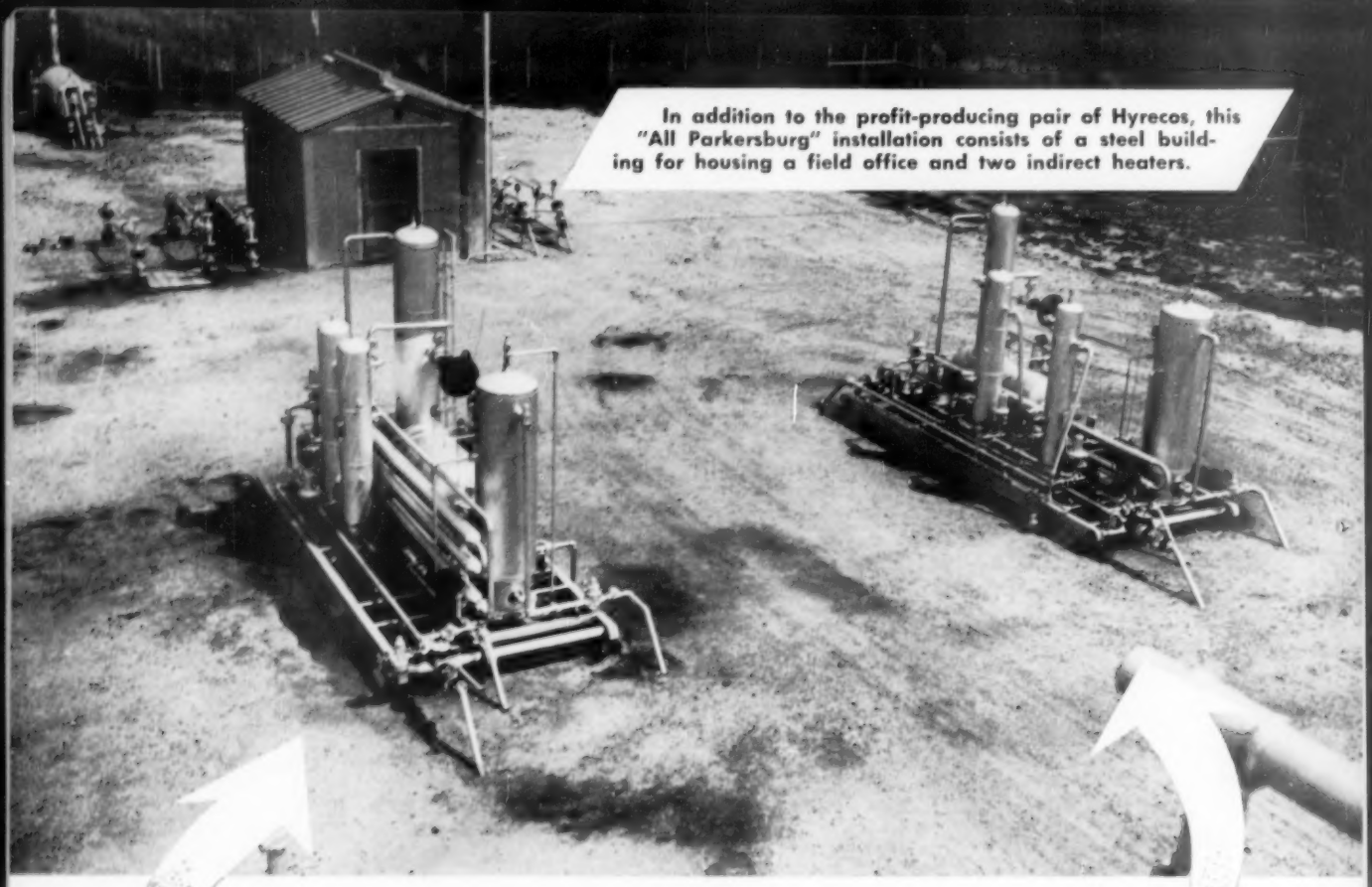
Magcobar
Complete
DRILLING MUD SERVICE

MAGNET COVE BARIUM CORPORATION

Houston, Texas



In addition to the profit-producing pair of Hyrecos, this "All Parkersburg" installation consists of a steel building for housing a field office and two indirect heaters.

A profit-producing PAIR of PARKERSBURG HYRECOS

Nothing in the field compares with these Parkersburg Hyrecos. They will recover more condensate per million cubic feet of gas than any comparable unit of the same price and capacity. They pay for themselves quickly out of increased liquid hydrocarbon recovery—become revenue producers in an unusually short period of time. They keep operating costs down to rock bottom by their simple design and trouble-free operation. Their low temperature separation processes high pressure gas without freezing trouble.

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Sinclair's new chief geologist . . .

. . . Cool Man For A Hot Spot

DR. JAMES L. MARTIN, JR., recently named chief geologist for Sinclair Oil & Gas Co., was getting ready to take off on a trip to Calgary. But the impression he gave was that of a person relaxing after a trip. His relaxed manner belies the facts:

Martin began his work with Sinclair as a geologist in Tallahassee, Fla., August 1943, and stayed there about 5 years. He spent the next 5 years in Jackson, Miss., and during that period became a district geologist. In April 1954, he was named division geologist at New Orleans.

Less than a year later, in February 1955, he was made assistant chief geologist and moved to Tulsa. On November 1, 1956, he moved into the post of chief geologist.

The rise from a staff geologist to chief geologist in a company as large as Sinclair in only slightly more than 13 years indicates the relaxed manner is deceptive. While deceptive, it is neither assumed nor false.

In fact Dr. Martin can accurately be described as "modest and unassuming." When asked what his new post meant in the way of added work and responsibility, he replied, "A little more of the same."

Sits in hot seat . . . A man who has risen so high, so fast, so young can reasonably be expected to go on. Dr. Martin's history with Sinclair indicates that he is one who will. He is just 41.

His "little more of the same" embraces quite a territory. Sinclair produces crude oil now in 14 states and is looking for it in others. His opinion is one of the critical factors in whether the company will or will not invest in another wildcat.

The responsibility of developing new and substantial crude oil sources is an important one in the Sinclair organization. Sinclair is in a deficit crude position. Present crude production is about one-third the company's refinery runs.

Migrates south . . . The Martins, all seven of them, now regard Tulsa as their home. It's a long way from and in considerable contrast to Dr. Martin's birthplace, Newark, N. J. Proximity to New York must have been anathema to him early. He was reared in Trenton, N. J., a considerable distance downstate from New York.

Dr. Martin departed the metropolitan area following his graduation from Princeton in 1937. His M.S. and Ph.D. degrees were obtained from Louisiana State University in 1939 and 1943. While earning his Ph.D., he worked with the Louisiana Geological Survey.

Stork nips golf . . . Golf was once one of Dr. Martin's favorite diversions. The periodic arrival of Martin offspring—five of them ranging from under 1 to 15—gradually eliminated such away-from-home activity. His less time-consuming hobbies now are roses and stamps.

His stamp collection is a specialized one. It is limited to stamps issued by the British possessions in the Western Hemisphere, ranging from British Honduras in Central America to British Guiana in South America. It could become further limited if these colonies finally federate and use the same stamps for all.

This interest in stamps has created an additional interest among the Martins, centering on such cities as Belize and Georgetown and such islands as St. Kitts, Tobago, and Barbados. It is developing a wanderlust in Dr. Martin, whose traveling is now confined to the United States and a bit of Canada. It wouldn't take much urging to induce him to take an interisland schooner bound from Tortola to Port-of-Spain.

Dr. Martin's interests—other than family, flowers, and philately — are limited to professional societies. He is a member of the American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, Tulsa Geological Society, New Orleans Geological Society, and Sigma Xi.

Personals

Gerald G. Loucks, geologist for Murphy Corp. in Denver, has resigned to join Kerr-McGee Oil Industries there.

Frank D. Gorham, Jr., geologist and chief operations officer with Pubco Petroleum Corp., Albuquerque, has been elected a vice president and director of the company.

J. D. STAHL

James D. Stahl, Houston district petroleum engineer for Union Producing Co., has been named field drilling and production superintendent. **Ervin O. Veselka,** field drilling and production superintendent for the company at Houma, La., will succeed Stahl as Houston district petroleum engineer. A graduate of Louisiana State University, Stahl joined Union in 1941. He has been district petroleum engineer since 1954. Veselka, a graduate of Texas A. & M. College, joined the company in 1948.

Personals

Greg Merrion, projects engineer with British-American Oil Producing Co. in Denver, has been promoted to district engineer and transferred to Midland, Tex.

Gene A. Carter, petroleum engineer with Magnolia Petroleum Co. in Great Bend, Kans., has joined Republic Natural Gas Co. in Corpus Christi, Tex.

James O'Connor Brown, plant manager for Petro-Tex Chemical Corp. in Houston, has been elected a vice president of the company. Petro-Tex is jointly owned by Tennessee Gas Transmission Co. and Food Machinery & Chemical Corp. Brown, formerly with Sinclair Refining Co., has held his present position with Petro-Tex since 1955.

Dr. Donald Garrett has been appointed assistant manager of American Potash & Chemical Corp.'s research department in Trona, Calif. He succeeds **Harold Mazza,** recently named manager of research at the company's Los Angeles plant. **Stanley Cohen** has been named head of the new products section at the Trona plant.

J. C. Gordon, Jr., petroleum engineer for Magnolia Petroleum Co., in the Pegasus district, has been transferred to Morgan City, La.

E. W. Masters, Los Angeles consultant, formerly with Shell Oil Co., has been appointed a director and consultant for Great Lakes Oil & Chemical Co. in Los Angeles.

Arthur J. Connell of Stone & Webster Engineering Corp. has been elected a vice president of the company. Connell joined Stone & Webster in 1951.

J. A. Burgbacher, mechanical engineer in Shell Oil Co.'s Houston division, has been named development engineer in the Houston production department.

Seven new members were elected to the executive committee of the Independent Petroleum Association of America at the association's annual meeting last week in Dallas. They are **J. H. Dunn,** Amarillo; **Harold B. Fell,** Ardmore, Okla.; **Paul C. McDonald,** El Dorado, Ark.; **W. M. Shoemaker,** Bradford, Pa.; **Joseph M. Thomas,** Bakersfield, Calif.; **A. R. Wherritt,** Shreveport; and **Harvey E. Yates,** Artesia, N. M. Officers of the association were reelected. They are **Robert L. Wood,** Midland, Tex., president; **Russell B. Brown,** Washington, general counsel; **W. L. Kistler, Jr.,** Tulsa, treasurer; and **I. C. Huff, Jr.,** Tulsa, executive manager and secretary.

Hanford Drummond, chief geologist in the Rocky Mountain area for Union Oil Co. of California, has resigned to open consulting offices in Denver.

J. Howard Pew, director and former president of Sun Oil Co., received his 55-year company service emblem at a Philadelphia company meeting in his honor. Approximately 1,200 Sun employes attended the anniversary celebration. Pew joined Sun in 1901 in the company's Marcus Hook refinery, which had just gone on stream.

E. B. Lagucki, development engineer in the Houston area for Shell Oil Co., has been appointed mechanical engineer in the production department, Houston division.

Ben K. Kelley has been appointed production superintendent for Leslie Oil Co. in Wichita, Kans. Kelley was formerly with Midland Oil Corp., Wichita Falls, Tex.

R. S. Tremaine, district geologist for Stanolind Oil & Gas Co. in San Antonio, Tex., has been transferred to Casper, Wyo. He replaces **Ian Macartney,** who has been transferred to the company's foreign exploration department. A graduate of U.C.L.A., Tremaine joined Stanolind in 1948.

Northern Tour Attracts Oil Officials

TOGGED out in cold-weather gear for a tour of northern Canada are officials of Continental Oil Co. and Hudson's Bay Co. Continental, with 75 per cent interest, and Hudson's Bay, with 25, are partners in Hudson's Bay Oil & Gas Co., Ltd. The 4-day tour began at Winnipeg, headed north, and ended at Calgary, where both Continental and Hudson's Bay Oil & Gas held directors' meetings. In the photo at right are Arthur B. Lawrence, Conoco director; W. J. Keswick, London, governor of Hudson's Bay Co.; and E. O. Faulkner, London, Hudson's Bay director. Hudson's Bay officials were hosts on the trip.

Mike Brady, geologist with Skelly Oil Co. in Amarillo, Tex., has resigned to open consultant offices there.

C. O. Walker, field engineer for El Paso Natural Gas Co., Farmington, N. M., has been promoted to division engineer.

S. W. Darling, assistant superintendent of The Texas Co.'s West Tulsa refinery, has been named superintendent. He succeeds **E. M. Reynolds,** who has retired. Darling joined the company in 1923. He was assistant superintendent of the company's Lawrenceville, Ill., refinery before coming to Tulsa. **J. J. Rasor,** special representative for liquid petroleum gas sales at Tulsa, will replace Darling as assistant superintendent.

J. D. GOODRICH

J. D. Goodrich, manager of mechanical engineering for Shell Oil Co. in New York, has been appointed production manager of the company's Tulsa area. He succeeds the late W. H. Burke. Goodrich will transfer to Tulsa in the spring of 1957 on completion of a special assignment in the New York office. **A. G. Copeland,** chief exploitation engineer of the Tulsa area, will take over as production manager in the interim. **R. E. Clark,** production manager of the company's Kansas division, will succeed Copeland as chief exploitation engineer.

Wallace L. Hammer has opened offices as consulting petroleum engineer in Abilene, Tex. Hammer has previously been with Stanolind Oil & Gas Co., Abilene Sample Log Service, and Russell Engineering. He is a graduate of the University of Texas.

M. L. Atkinson, Philtex division superintendent for Phillips Petroleum Co. in Ponca City, Okla., has been appointed superintendent of the company's Central division in Oklahoma City. He succeeds **George J. Turner,** who has retired. Atkinson has been with Phillips since 1925.

George D. Comnas and **Harry L. Conner** have been elected vice presidents of Esso Export Corp. Comnas, a graduate of Texas A. & M. College, was formerly with Humble Oil & Refining Co. as chemical engineer and geochemist, and later petroleum engineer with Creole Petroleum Corp. He has been a director of Esso Export since 1954. Conner joined the Standard Oil Co. (N. J.) organization in 1923.

English Johnson has opened a consulting geological office in Tyler, Tex. Johnson was formerly with Sohio Petroleum Co.

W. A. Whitmire has been appointed petroleum engineer in Denver for the oil development department of Union Pacific Railroad. He succeeds **C. L. Nordstrom.**

C. Spencer Clark, chairman of the board of Cascade Natural Gas Corp., Seattle, has been elected president of the company. He succeeds **Stewart Matthews,** who has resigned. Matthews will remain as a director and consultant of the firm.

Frank Cooter, southwestern division exploration manager for Cities Service Oil Co., has transferred from Fort Worth to Midland, Tex., in a move changing headquarters of the company's southwestern exploration division. Others transferring to Midland from Fort Worth include **Ed J. Gemmill,** assistant division manager; **R. S. Hunt,** division exploitation geologist; **Paul Hyatt,** division exploration geologist; **John M. Armstrong,** division geophysicist; **Bob Sutton,** division landman; and **W. B. Weaver, Earl L. Creasey,** and **John R. Kirwan,** attorneys. **Alan Roberts** of the Midland office has been transferred to Fort Worth as special representative of the company there.

Personals

Henry N. Mallon, president of Dresser Industries, Inc., Dallas, has been elected chairman of the board. He will continue as chief executive officer of the company. **J. B. O'Connor,** executive

J. B. O'CONNOR

H. N. MALLON

vice president, will succeed Mallon as president. The changes were made in order to strengthen the company's top management organization in view of Dresser's expanding activities. Mallon has been with the company since 1929. O'Connor joined Dresser in 1937. He has been executive vice president since 1944.

John D. Moores has joined the engineering staff of W. C. Fatjo, Inc., Lafayette, La. Moores was formerly with Loffland Brothers Co. in Houston. He is a graduate of the University of Tulsa.

DEATHS

Julio G. Bejarano, 54, manager of Shell Chemical Corp.'s Denver plant, died October 24 in Denver. In 1944 Bejarano guided construction of the first butadiene synthetic rubber plant west of the Rockies at Torrance, Calif. He later managed Shell's plant at Dominguez, Calif. He had supervised the Denver plant since 1952.

Kenneth E. Thornton, 58, production superintendent for Sinclair Oil & Gas Co. in Tulsa, died October 29 in Tulsa. Thornton had been with Sinclair since 1921. He came to Oklahoma from Casper, Wyo., in 1954.

Russell Byrom, 34, and **James A. Rivet,** 61, died of burns received October 22 in a flash fire at Magnolia Petroleum Co.'s Beaumont refinery. Byrom, job foreman at the refinery, died October 25. Rivet, pipe foreman, died October 29.

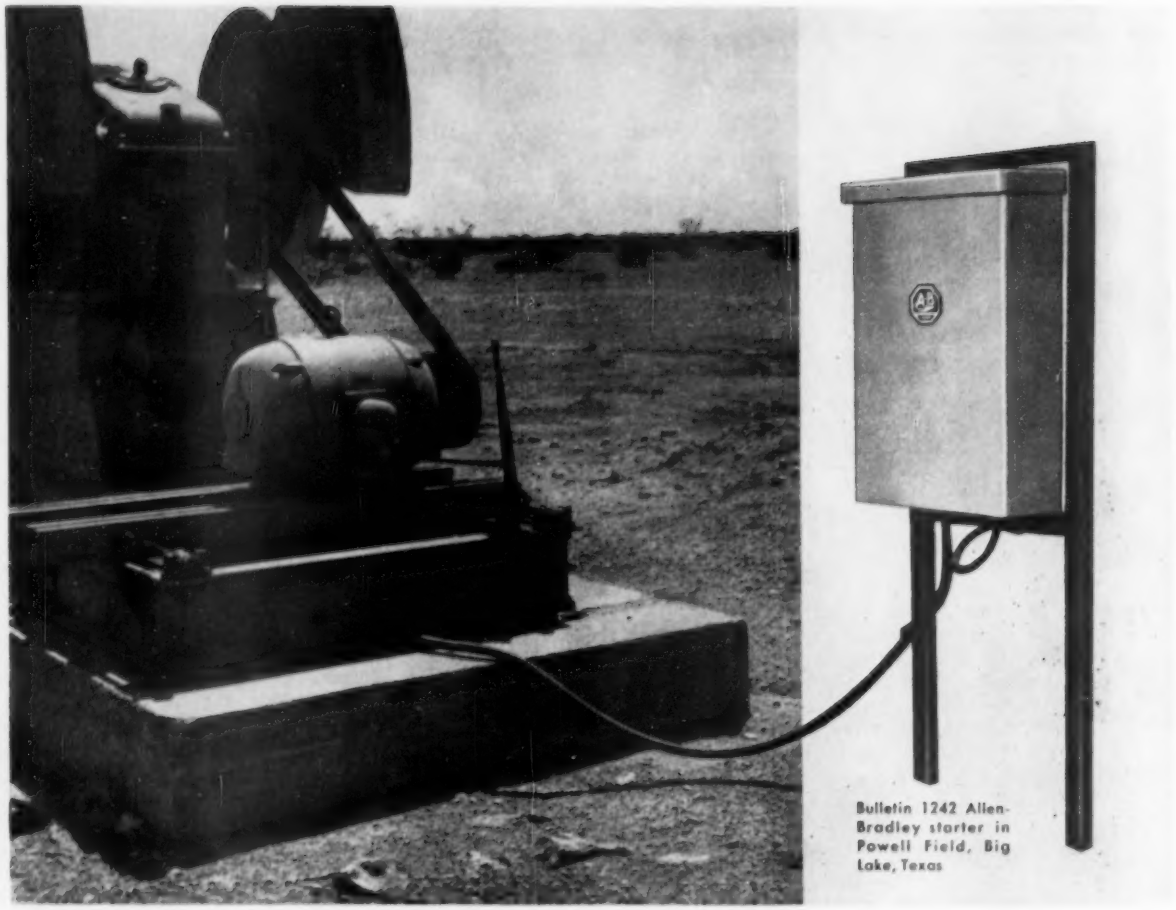
Robert S. Mann, Shell Oil Co.'s director of geology in Calgary, and formerly geological consultant in San Antonio, died recently in San Antonio.

Hiram Ward (Hi) Camp, 72, retired manager of Cities Service Oil Co.'s refining division, died October 29 in Tulsa. A graduate of the University of Washington, Camp joined Cities Service in Bartlesville, Okla. He became manager of the refining division in 1935. He was active in the Western Petroleum Refiners' Association and other technical and trade societies.

Granville Humason, 81, oil equipment inventor, died October 26 in Houston. Among Humason's inventions was the cross roller type oil drilling bit. In addition to his inventions, Humason was active in development of the Caddo field in West Louisiana and the Humble field in Texas.

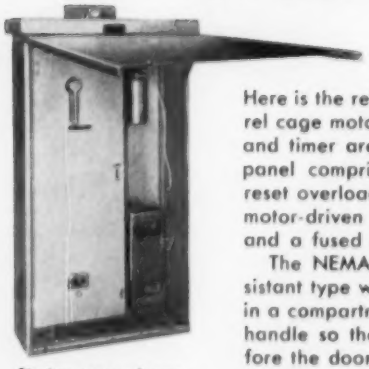
William S. Mackey, 67, Houston independent, died October 28 in Houston. A native of Sedalia, Mo., and graduate of Princeton University, Mackey went to Houston in 1926.

Henry B. King, 54, field engineer for Tret-O-Lite Co. in Shawnee, Okla., for 26 years, died October 20 in Shawnee.



Bulletin 1242 Allen-Bradley starter in Powell Field, Big Lake, Texas

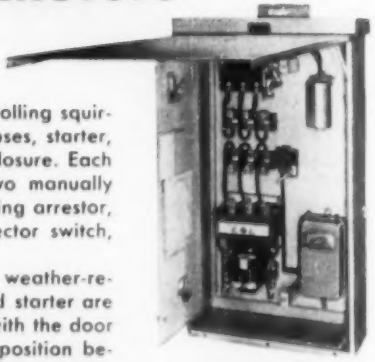
An Automatic Starter . . . with Time Switch for Oil Field Pump Motors



Starter open—inner switch cabinet closed

Here is the reliable Allen-Bradley starter for controlling squirrel cage motors on oil well pumps. Disconnect, fuses, starter, and timer are contained in a weatherproof enclosure. Each panel comprises a Bulletin 709 starter with two manually reset overload relays, undervoltage relay, lightning arrestor, motor-driven time switch, a Hand-Off-Auto selector switch, and a fused disconnect.

The NEMA Type 3 enclosure is the outdoor, weather-resistant type with a drip hood. The disconnect and starter are in a compartment with hinged door interlocked with the door handle so that the handle must be in the OFF position before the door can be opened. The fuses and switch are then "dead". . . a valuable safety feature. Send for Bulletin 1242.



Starter open—inner switch cabinet open

Allen-Bradley Co.
1304 S. Second St.
Milwaukee 4, Wis.

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SOLENOID MOTOR CONTROL

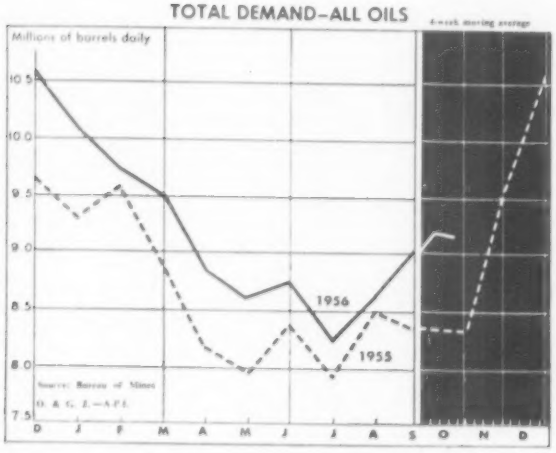
QUALITY

In Canada—
Allen-Bradley Canada Ltd.
Galt, Ont.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,002,625	DOWN	12,750	UP	169,245
Crude stocks	281,557,000	UP	2,099,000	UP	24,527,000
Completions	1,041	DOWN	72	DOWN	42
Refinery runs	7,670,000	UP	140,000	UP	194,000
Gasoline stocks	171,985,000	DOWN	1,102,000	UP	20,378,000
Kerosine stocks	34,518,000	UP	589,000	DOWN	1,918,000
Distillate stocks	156,851,000	UP	1,563,000	UP	5,285,000
Residual stocks	47,493,000	DOWN	222,000	UP	1,194,000
Four-product stocks	410,847,000	UP	828,000	UP	24,939,000
Total imports	1,547,200	DOWN	1,200	UP	433,300



Natural-Gasoline Prices Decline; No Improvement Noted in Refinery Grades

EXCESS gasoline inventories of long standing, and slowness in the anticipated seasonal pickup in demand for the heavier fuel products brought scattered concessions in a few spot sales over the past week. Refinery price spreads of the previous week were generally unchanged.

Observers agree that the increasingly critical Middle East situation, should it result in a curtailment of crude and product shipments from that area, could quickly end any weakness in domestic markets.

Natural gasolines were reduced 0.5 cent per gallon Group 3 to 4.5-5.0 cents. The reduction in the Breckenridge area was to 4-4.5 cents from a flat price of 4.5 cents.

A reduction in natural-gasoline quotations at a time when firm or advancing prices are to be expected is explained as reflecting the weak refinery gasoline market. The entire southwestern natural-gasoline market, particularly in Texas, has suffered in recent weeks from the slow export and coastwise movement of gasoline from Gulf Coast refineries.

It is also explained that the refinery and jobber demand for natural gasolines has not increased as anticipated in the Middle West.

The action of Standard of Indiana in reducing gasoline tank-wagon prices 0.1 to 1 cent per gallon, effective October 29, will probably affect refinery markets.

The reductions were effective in several large consuming centers, including the largest, Chicago, where the cut was 1 cent per gallon. Previously Indiana Standard had made local reductions at many points where the company markets under a policy of suggested retail prices.

The company explained that the reductions were due to a continuance of excessive gasoline supplies. Reports indicated that the Standard reductions were generally met by competitors including price cutters who sell a cent a gallon or more under the major distributors.

The reduction in wholesale markets was interpreted to be the result of a prolonged situation in which tank-car and tank-truck sales from refineries and pipeline terminals serving the Middle West, have been a half cent per gallon or more under the published prices for Group 3. This has brought the inevitable price wars and finally forced the general action taken by Indiana Standard.

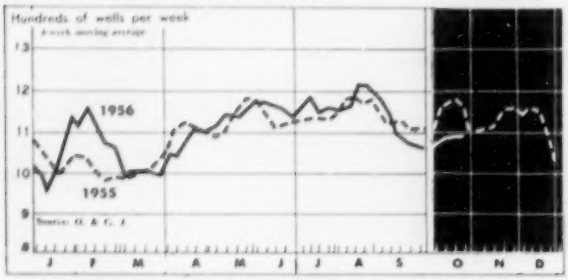
With large refinery gasoline inventories in the Middle West and Mid-Continent, and the season of minimum consumption under way, it is feared that a reduction in published refinery tank-car prices will result.

A situation similar to that of the Standard of Indiana marketing area brought a reduction of 0.2 cent per gallon in wholesale regular and premium grades of gasoline in New York and New England states. Socony Mobil Oil Co., Inc., in announcing the reduction effective October 31, said the changes reflected weakness in primary markets.

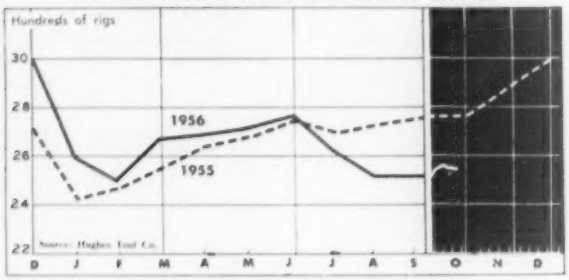
There is some indication of weakness in Mid-Continent and Middle West residual fuel oil centering in the high-sulfur grades. A few concessions in spot sales have been made for spot and November delivery. At the same time the Gulf Coast residual market was aided by additional cargo purchases for export movement.

The trade attitude regarding all fuel oils—residual and distillates—is that inventories and current production are not excessive for the winter season of maximum consumption. It is felt that prices will stiffen as soon as weather conditions and expanding industrial operations are reflected in spot and contract demands.

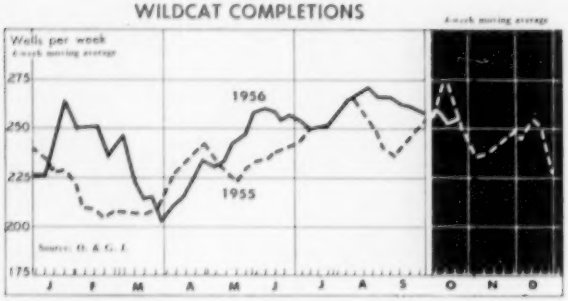
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	10-29-56	10-22-56	10-31-55
North Central and East	117	118	147
Southeast	40	41	48
Okla., Kans., Ark., Mo.	439	452	546
Louisiana	443	445	397
North and East Texas-Panhandle	376	371	400
Gulf and South Texas	239	245	250
West Texas-New Mexico	509	500	540
Rocky Mountain	266	264	300
Pacific Coast	108	117	142
Total United States	2,537	2,553	2,770
Western Canada	234	225	186

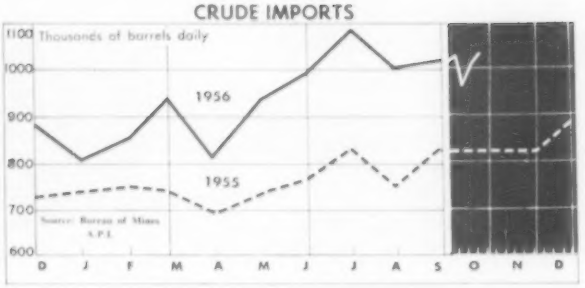
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED OCTOBER 27, 1956

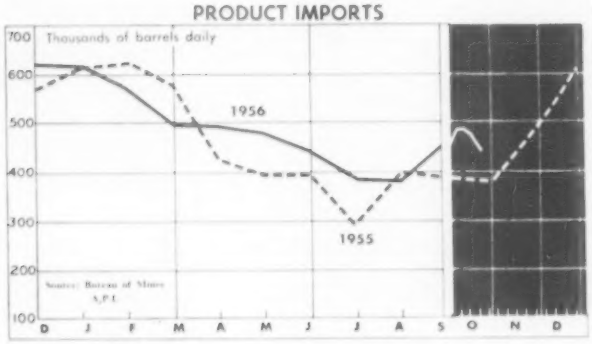
	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1956				
	Comp.	Oil	Gas	Dry	Footage	1956	1955	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	4	1	0	3	25,130	92	65	0	0	0	3	3	0	0	1	40	41
Arkansas	23	16	1	6	71,488	765	665	0	0	1	5	6	29	0	5	121	155
California	33	23	1	9	137,251	1,816	2,023	0	0	0	8	8	43	0	9	374	426
Colorado	18	2	0	16	86,264	985	1,231	0	0	0	13	13	22	0	13	492	527
Illinois	65	25	1	39	145,850	3,256	3,206	0	0	0	13	13	43	0	3	584	630
Indiana	12	3	0	9	22,538	568	600	0	0	0	3	3	15	0	1	101	117
Kansas	90	37	8	*45	320,641	4,110	4,162	2	0	2	23	27	103	3	35	752	893
Kentucky	45	12	8	25	63,000	1,563	1,289	2	0	0	9	11	36	0	1	325	362
Louisiana	75	46	4	25	392,510	3,156	3,313	0	1	0	8	9	96	48	50	442	636
North	48	38	4	6	127,469	1,395	1,706	0	0	0	1	1	26	2	3	182	213
South	22	6	0	16	204,084	1,425	1,607	0	0	0	6	6	57	40	34	229	360
Offshore	5	2	0	3	60,957	336		0	1	0	1	2	13	6	13	31	63
Michigan	11	6	0	5	28,688	365	445	1	0	0	4	5	9	0	2	132	143
Mississippi	9	4	0	5	66,487	365	369	1	0	0	3	4	14	1	1	161	177
Montana	8	4	0	4	43,372	380	320	0	0	0	4	4	10	0	1	129	140
Nebraska	15	4	0	11	74,640	797	723	1	0	0	9	10	33	0	1	361	395
New Mexico	23	13	5	5	165,386	1,571	1,394	3	1	0	5	9	45	1	8	167	221
Northwest	6	1	3	2	22,137	697	466	1	0	0	2	3	11	0	7	59	77
Southeast	17	12	2	3	143,249	874	928	2	1	0	3	6	34	1	1	108	144
North Dakota	6	2	0	4	45,157	217	211	0	0	0	4	4	8	0	0	57	65
Ohio	26	11	5	10	57,735	893	1,005	0	0	1	0	1	2	0	4	6	12
Oklahoma	147	83	8	56	464,796	6,879	7,001	3	0	1	14	18	106	18	32	574	730
Pennsylvania-New York	7	0	6	1	27,932	755	1,261	0	0	1	0	1	0	0	12	11	23
Texas	378	229	20	129	1,746,188	18,250	16,680	21	0	10	76	107	626	31	164	3,844	4,665
Southwest (1 & 4)	50	26	6	18	224,678	2,609	2,565	2	0	5	11	18	112	6	58	729	905
Gulf Coast (2 & 3)	43	16	7	20	309,124	2,168	2,084	1	0	3	8	12	57	16	57	586	716
East (5 & 6)	32	13	3	16	182,084	964	811	0	0	1	13	14	14	2	6	326	348
North Central (7-B & 9)	127	71	0	56	392,965	6,549	6,239	10	0	0	30	40	275	0	11	1,540	1,826
West (7-C & 8)	103	85	1	17	548,534	4,865	4,105	8	0	1	12	21	151	0	11	607	769
Panhandle (10)	23	18	3	2	88,803	1,095	876	0	0	0	2	2	17	7	21	56	101
Utah	0	0	0	0	0	100	79	0	0	0	0	0	6	0	4	50	60
West Virginia	24	1	13	10	55,533	567	534	0	0	0	0	0	0	0	10	9	19
Wyoming	21	6	0	15	94,161	724	755	0	0	0	13	13	14	0	10	196	220
Miscellaneous (S. D.)	1	0	0	1	586	71	57	0	0	0	1	1	4	0	0	60	64
Total United States	**1,041**	528	80	433	4,135,333	48,245	47,386	34	2	16	218	**270**	1,264	102	367	8,988	10,721
Total previous week	1,113	555	105	453	4,403,788			28	3	15	213	259	1,230	100	351	8,770	10,451
Total Oct. 29, 1955	1,083	621	65	397	4,334,822			23	4	4	186	217	1,352	178	291	8,332	10,153
Cumulative 1956	48,245	25,963	3,365	18,917	194,075,060												
Western Canada	50	32	2	16	241,398	2,605											

Service wells included: *1.

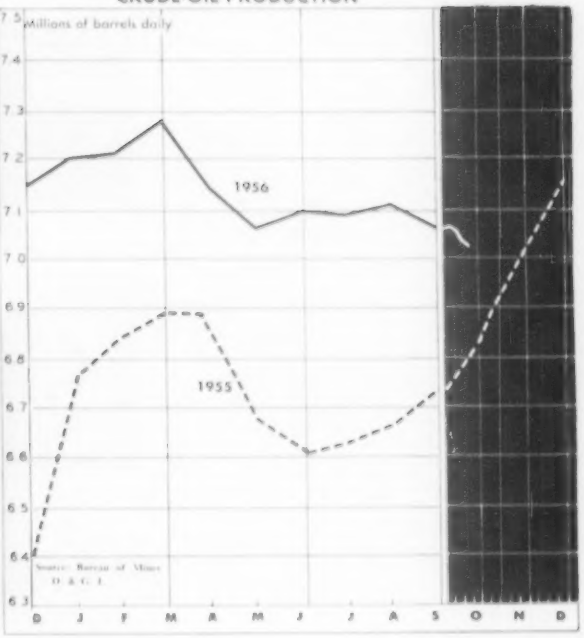
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

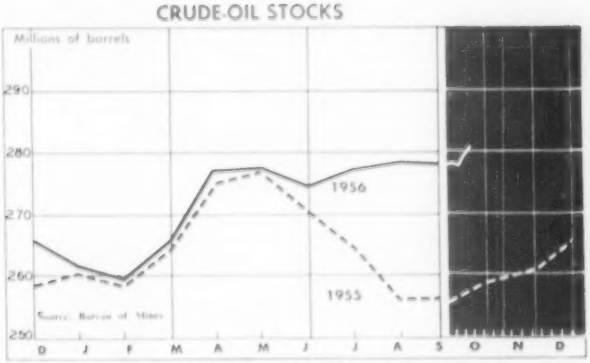


DAILY AVERAGE PRODUCTION FOR WEEK

	October 27, 1956 — Lease			Oct. 20
	Crude oil	condensate	Total	total
Alabama	10,000		10,000	10,050
Arkansas	77,400	300	77,700	77,450
California	955,200		955,200	958,600
Colorado	158,100		158,100	160,500
Eastern	50,800		50,800	50,300
Florida	1,375		1,375	1,375
Illinois	233,200		233,200	233,600
Indiana	30,500		30,500	31,300
Kansas	335,500		335,500	332,100
Kentucky	46,400		46,400	46,200
Louisiana	735,800	63,500	799,300	799,100
North	118,300	†2,000	120,300	120,100
South	617,500	61,500	679,000	679,000
Michigan	26,800		26,800	26,800
Mississippi	108,950	4,700	113,650	113,650
Montana	61,400		61,400	61,300
Nebraska	38,700		38,700	39,050
Nevada	200		200	200
New Mexico	241,500	3,700	245,200	245,300
North Dakota	35,200		35,200	35,300
Oklahoma	†562,700		†562,700	†572,200
Texas	2,876,000	51,900	2,927,900	2,927,900
Dist. 1	56,000	500	56,500	56,500
Dist. 2	141,000	8,100	149,100	149,100
Dist. 3	410,000	24,500	434,500	434,500
Dist. 4	227,000	6,200	233,200	233,200
Dist. 5	41,000	450	41,450	41,450
Dist. 6	121,000	5,900	126,900	126,900
East Texas Field	196,000		196,000	196,000
Dist. 7-B	158,000	50	158,050	158,050
Dist. 7-B	170,000	3,900	173,900	173,900
Dist. 8	1,043,000	1,600	1,044,600	1,044,600
Dist. 9	211,000	500	211,500	211,500
Dist. 10	102,000	200	102,200	102,200
Utah	5,100		5,100	7,500
Wyoming	287,600		287,600	285,500
Others	‡100		‡100	‡100
Total U. S.	6,878,525	124,100	**7,002,625**	7,015,375
Change from prev. week, down			**12,750**	
Canada	†509,448		†509,448	†503,288
Total U. S. prod., January 1-October 27			2,146,043,850 bbl.	
Same period last year (crude oil plus cond.)			*2,025,269,361 bbl.	

*Includes 33,732,150 bbl. condensate. †Week ended previous Monday. ‡S. Dakota.

CRUDE-OIL STOCKS



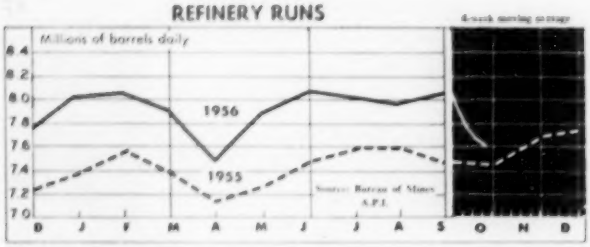
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

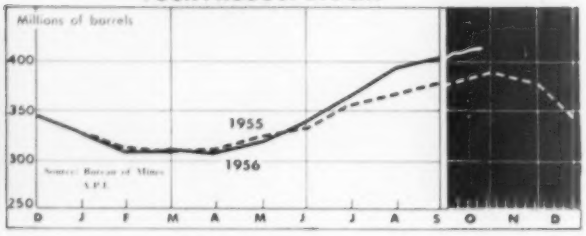
	10-20-56	10-13-56	10-22-55
Pennsylvania Grade	2,434	2,466	3,252
Other Appalachian	2,534	2,583	1,917
Illinois, Indiana, Michigan	11,012	11,288	9,353
Nebraska, North Dakota	2,568	2,263	2,537
Kansas	10,067	9,753	8,063
Oklahoma	24,747	25,053	20,717
Arkansas	2,870	2,700	2,415
Louisiana	17,467	18,727	16,151
North	2,632	2,556	2,461
South	14,835	16,171	13,690
Mississippi	2,948	3,046	3,191
New Mexico	9,148	8,631	7,277
Texas	127,181	125,582	121,836
East Texas proper	9,195	8,580	9,353
West Texas	62,158	61,150	57,167
Texas Gulf	23,876	24,083	25,644
Other Texas	31,952	31,769	29,682
Wyoming	16,970	17,206	14,223
Other Rocky Mountain	6,364	6,518	5,798
California	29,159	28,648	27,150
Foreign	†16,088	14,994	13,140
Total	281,557	279,458	257,030

*Bureau of Mines. †Includes 4,682,000 bbl. in California.

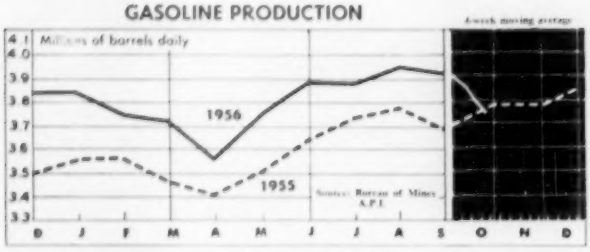
REFINERY RUNS



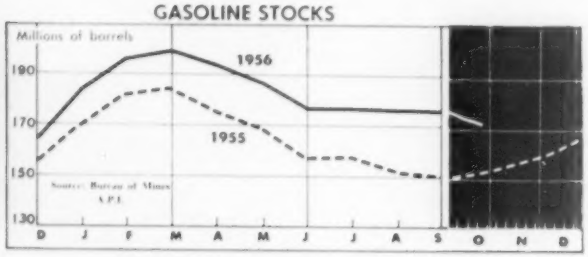
FOUR-PRODUCT STOCKS



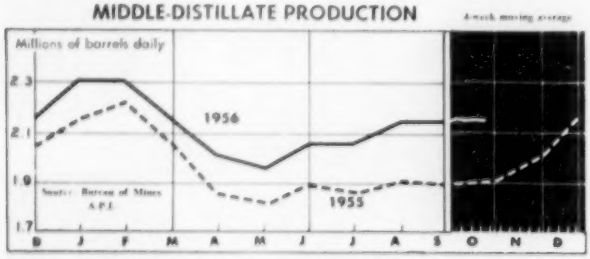
GASOLINE PRODUCTION



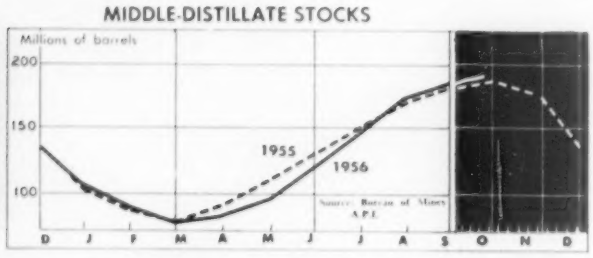
GASOLINE STOCKS



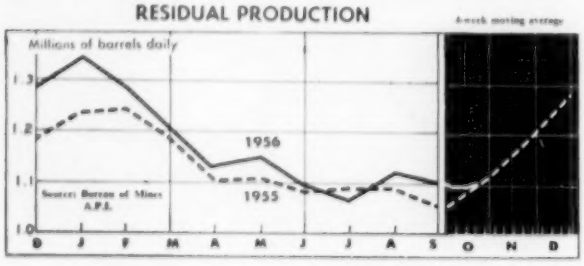
MIDDLE-DISTILLATE PRODUCTION



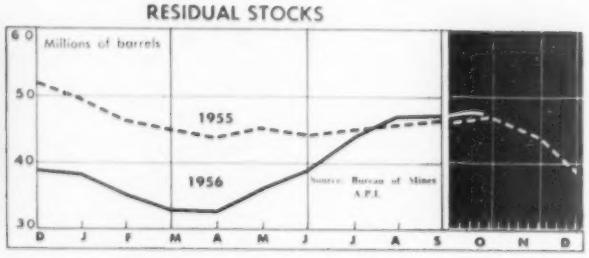
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, OCTOBER 26, 1956

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, October 1955—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,174	456.0	54.4	321.6	215.6	41,778	13,993	59,698	12,393	1,056	452.1	31.9	254.5	201.8
Appalachian:														
District 1	107	43.7	6.1	28.0	4.0	4,299	595	3,550	465	100	42.0	4.7	19.7	7.1
District 2	77	40.3	2.4	14.1	11.1	2,832	738	979	330	98	48.2	5.4	12.4	13.5
Ind., Ill., Ky.	1,362	690.7	78.7	258.4	177.6	29,716	7,745	24,615	6,035	1,357	754.7	57.9	258.0	177.1
Minn., Wis., Dak.	75	37.6	2.0	23.1	3.7	6,433	1,575	8,662	127	(§)	(§)	(§)	(§)	(§)
Okla., Kans., Mo.	601	341.9	8.0	136.9	30.1	14,275	1,809	13,686	1,557	656	391.1	12.2	163.0	19.4
Inland Texas	261	200.4	8.0	62.3	24.0	7,538	571	1,756	1,829	243	192.8	8.7	49.6	23.2
Texas Gulf Coast	1,838	883.1	124.3	456.3	236.9	24,091	3,417	16,805	6,549	1,813	866.5	113.0	450.9	230.7
La. Gulf Coast	688	335.4	73.3	173.9	46.4	10,090	2,423	7,913	1,558	684	349.3	58.8	162.0	43.2
N. La. and Ark.	67	37.1	4.4	20.2	5.0	4,384	843	1,980	252	90	33.3	7.9	22.1	6.2
Rocky Mountain:														
New Mexico	23	11.9	0.6	4.1	3.3	477	9	139	59	22	11.7	0.4	4.0	2.9
Other Rocky Mtn.	259	112.9	2.4	56.7	31.9	4,617	418	3,364	890	240	115.4	2.6	58.2	36.7
West Coast	1,138	513.4	18.3	214.3	316.4	21,455	382	13,704	15,449	1,108	508.8	5.1	158.0	361.5
Oct. 26, 1956	7,670	3,704.4	382.9	1,769.9	1,106.0	171,985	34,518	156,851	47,493	7,465	3,765.9	308.6	1,612.4	1,123.3
Oct. 19, 1956	7,530	3,665.4	396.0	1,711.3	1,106.0	173,087	33,929	155,288	47,715					
Oct. 28, 1955	7,476	3,867.9	292.9	1,607.1	1,115.9	151,607	36,436	151,566	46,299					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipe lines. §Included in Indiana, Illinois, Kentucky district.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (88 octane)	11.00-11.50
Premium (96 octane)	12.75-13.25
Gulf Coast (cargoes for coastwise or export movement):	
Regular (90 octane)	11.00-11.50
Regular (92 octane)	11.25-11.75
Premium (97 octane)	12.75-13.25
Premium (98 octane)	13.00-13.50
California—Los Angeles (rack):	
Regular (84 octane)	12.1-12.6
Premium (93 octane)	13.35
Premium (96 octane)	14.3-14.6
Caribbean area (cargoes):	
Regular (87 octane)	10.00
Premium (93 octane)	11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
★ Grade 26-70	4.5-5.0
Breckenridge:	
★ Grade 26-70	4.0-4.5

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	10.00-10.25
Diesel oil (58 d.i. and above)	9.75-10.00
Distillate No. 1	9.625-9.875
Distillate No. 2	9.00-9.25
Gulf Coast (cargoes):	
Kerosine 41-43	9.5
Distillate No. 2	8.75
New York Harbor (barges):	
Kerosine 41-43	11.25
Distillate No. 2	10.65
Diesel fuel, 48-52 d.i.	10.95
Caribbean area (cargoes):	
Distillate No. 2	8.75

WAX (F.B.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$2.05-2.10
Gulf Coast (cargoes):	
Bunker C fuel	$2.10
New York Harbor (barges):	
Bunker C fuel	$2.80
Caribbean (cargoes):	
Bunker C at Aruba, N.W.I.	$2.10
California (rack):	
Bunker C fuel, Los Angeles	$2.15-2.25

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	24
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.75
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	27
200 vis. neutral (180 at 100°), 25 p.t.	25

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.02				
15-15.9	2.08				
16-16.9	2.13				
17-17.9	2.19				
18-18.9	2.24				
19-19.9	2.30				
20-20.9	2.35	$2.50		$2.37	
21-21.9	2.41	2.52		2.39	
22-22.9	2.47	2.54		2.41	
23-23.9	2.52	2.56		2.43	
24-24.9	2.58	2.58	$3.01	2.45	
25-25.9	2.64	2.60	3.03	2.47	$2.13
26-26.9	2.69	2.62	3.05	2.49	2.19
27-27.9	2.76	2.64	3.07	2.51	2.24
28-28.9	2.83	2.66	3.09	2.53	2.29
29-29.9	2.91	2.68	3.11	2.55	2.34
30-30.9	2.97	2.70	3.13	2.57	2.39
31-31.9	3.04	2.72		2.59	2.44
32-32.9	3.12	2.74		2.61	2.48
33-33.9	3.20	2.76		2.63	2.52
34-34.9	3.27	2.78		2.65	2.56
35-35.9	3.34	2.80		2.67	2.60
36-36.9	3.39	2.82		2.69	2.64
37-37.9		2.84		2.71	2.66
38-38.9		2.86		2.73	2.68
39-39.9		2.88		2.75	2.70
40 and up		2.90		2.77	2.72

*Includes Oklahoma, Kansas, North Dakota, West Texas (sweet), North Central Texas, North Louisiana, Arkansas. †Low-cold-test Gulf Coast. ‡Sour.

Effective dates: California, February 7, 1956; east of California, June 15, 1953; Pennsylvania Grade, August 16, 1956.

Some crudes in North Central Texas, West Central Texas, and Texas Panhandle have been shifted to the intermediate schedule with $2.83 for 40° and 2 cents per degree drop. Effective dates range from July 15, 1956, to August 10, 1956.

FLAT PRICES

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	4.68
Middle District	4.50
Southwest Pennsylvania	4.21
West Virginia	4.03
Buckeye Grade	4.07
Zanesville Grade	3.15
Illinois Basin	**2.90**
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.60
Redwater (Alta.) D-3	2.49
Smiley-Viking (Sask.)	2.26
Fosterton (Sask.)	1.29
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.8°, Tucupido	*3.40
San Joaquin, 41°-41.9°, Puerto La Cruz	*3.04
Oficina, 35°-35.9°, Puerto La Cruz	$2.80
Tia Juana medium, 26.5°-26.9°, Amuay§	‡2.30
Quiriquire, 16.5°-16.9°, Caripito	‡2.21
Lagunillas heavy, flat, Amuay or Las Piedras§	2.05
Bachaquero, 16.5°-16.9°, Amuay or Las Piedras§	‡1.90

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Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
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Arabian, 36.0°-36.9°, Sidon	2.46
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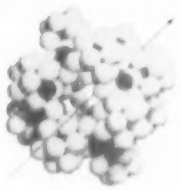

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With degree in Physical Chemistry or Chemical Engineering plus 5 years' petroleum production engineering experience which should include 2 years' study of reservoir fluid behavior.

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BOX J-785,

THE OIL AND GAS JOURNAL,
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With minimum of 7 to 8 years experience in general production engineering, secondary recovery, cost engineering or reservoir studies.

For personal interview—CONTACT—Taylor Little, November 11, 12 & 13 Skirvin Hotel, Oklahoma City, Okla and John T. Wilson, November 16, 17 & 18, Lamar Hotel, Houston, Texas. For other information write Employment Supervisor,

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BOX J-784,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

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Applications are now being taken for the following positions:

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A mature and responsible person with thorough training and broad experience in both operation and maintenance of petroleum refinery equipment to have charge of both of these functions in the refinery, the pipe line and the terminal.

Chief Engineer

An engineer with general technological experience to have charge of both process design and mechanical design work. Scope of position is open and dependent on available person.

Chief Chemist

Responsible person with experience in petroleum product blending and familiarity with latest refinery laboratory methods.

Process Foreman

An operations supervisor of broad experience to work under the Plant Superintendent and to be in charge of all operating units.

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An experienced supervisor familiar with all types of refinery equipment to work under the Plant Superintendent and to be in charge of maintenance and small construction in the refinery, pipe line and terminal.

Write, giving resumé including experience with processes listed, to

PONTIAC EASTERN CORP.
P. O. Box 1581, Corpus Christi, Texas
Applications for other positions will be taken at a later date.

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Texas and Oklahoma. Experience with radioactive sources and tracers. Salary and commissions. Send complete details. Your inquiry will be considered promptly and confidentially. Box J-788, The Oil and Gas Journal, Tulsa, Oklahoma.

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Staff engineer to advise and assist operating and technical management at 70,000 B/D refinery near Santos, a modern resort city on Brazilian seacoast. Must be graduate engineer with 10 - 20 years technical and practical experience in petroleum refining.

High initial salary commensurate with experience plus generous allowances.

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Sui Gas Aiding Wildcat

If Pakistan Petroleum Co., Ltd., finds commercial production in its latest wildcat in the Indus Valley of West Pakistan, Sui gas field discovered by the company 4 years ago can claim an assist.

The boilers of the steam rig that is drilling the test near the village of Theri, 4 miles from Khairpur, are being fired by Sui gas. The company built two pipelines to the location before spudding in. One moves the water supply for the operation from the Rohri canal. The other brings Sui gas 24 miles from the field to the drilling operation.

The Khairpur well is P.P.L.'s third major wildcat effort in the last several months. It is drilling other tests at Karachi and Jhelum. The latest well is projected to 12,000 ft.

Japan's Tanker Fleet Busy

Japan's tanker fleet, now pushing 1,000,000 dwt., carries 60 per cent of the crude and products imported by the country.

The tanker fleet has grown from a postwar low of only 23 vessels of 236,000 dwt. in 1950 to 57 ships with a total tonnage of 990,712 dwt. Five other ships totaling 152,000 dwt. are building in Japanese shipyards.

Last year Japan imported an average of 185,340 bbl. daily of crude and products, with 59.8 per cent of the total carried in Japanese ships. The little country imported an average of 37,850 bbl. daily of products and 147,490 bbl. daily in crude.

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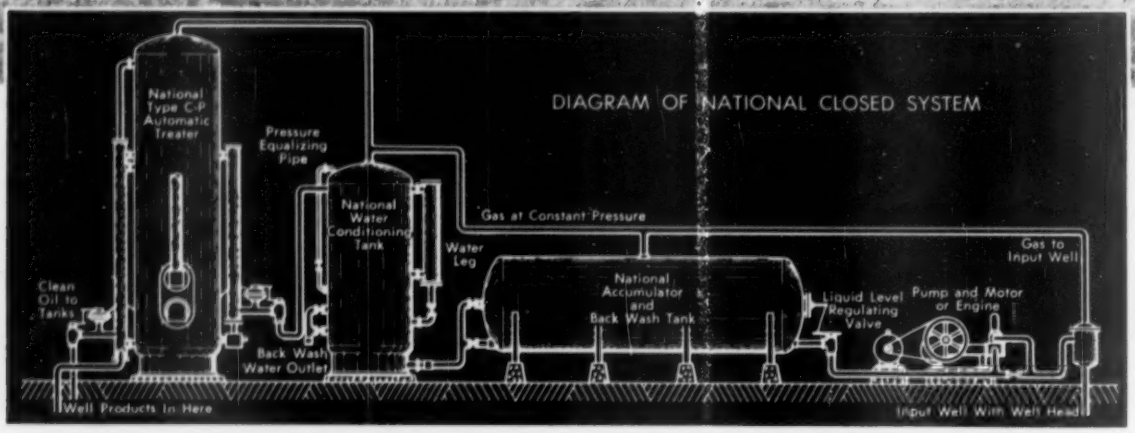
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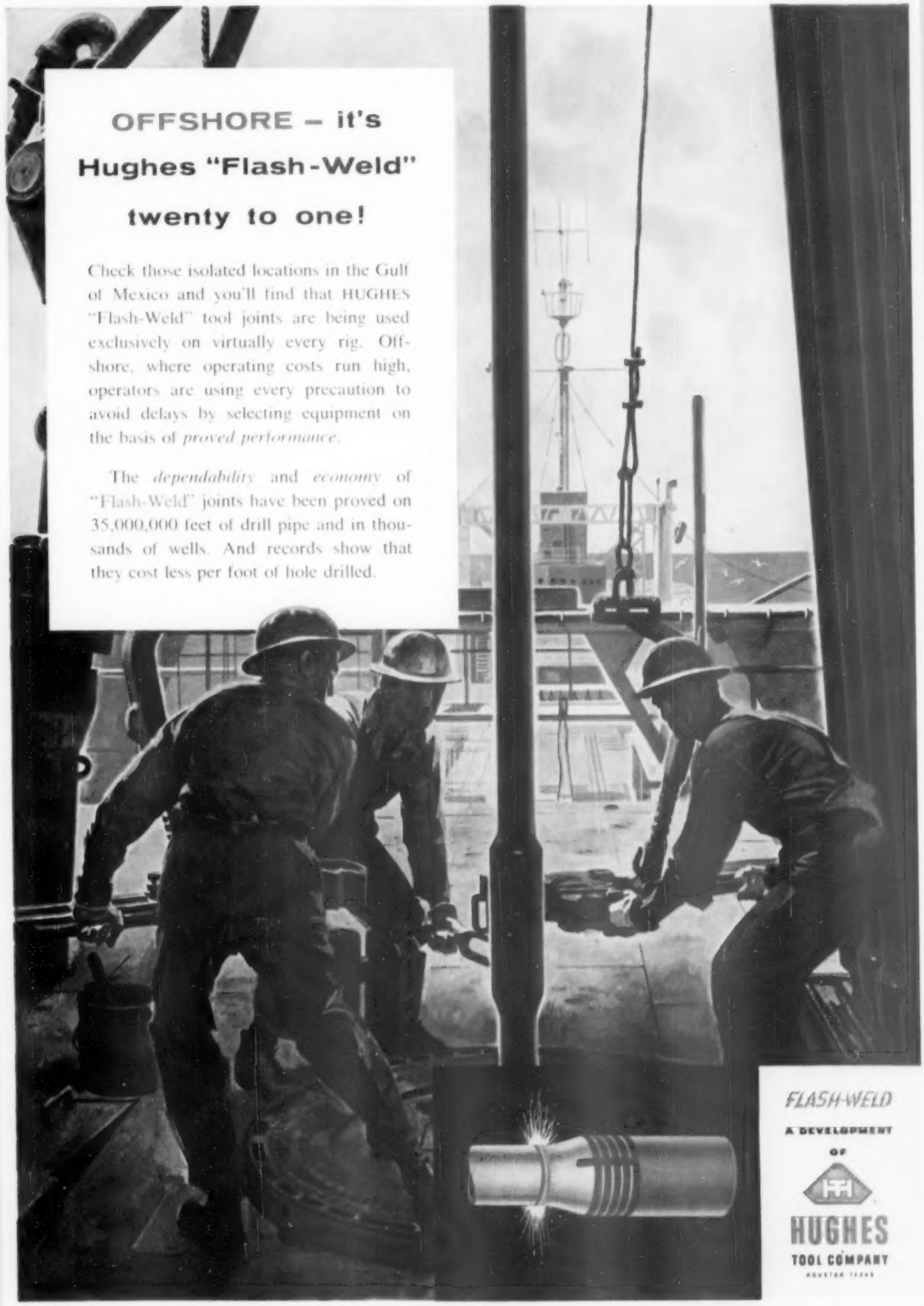

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